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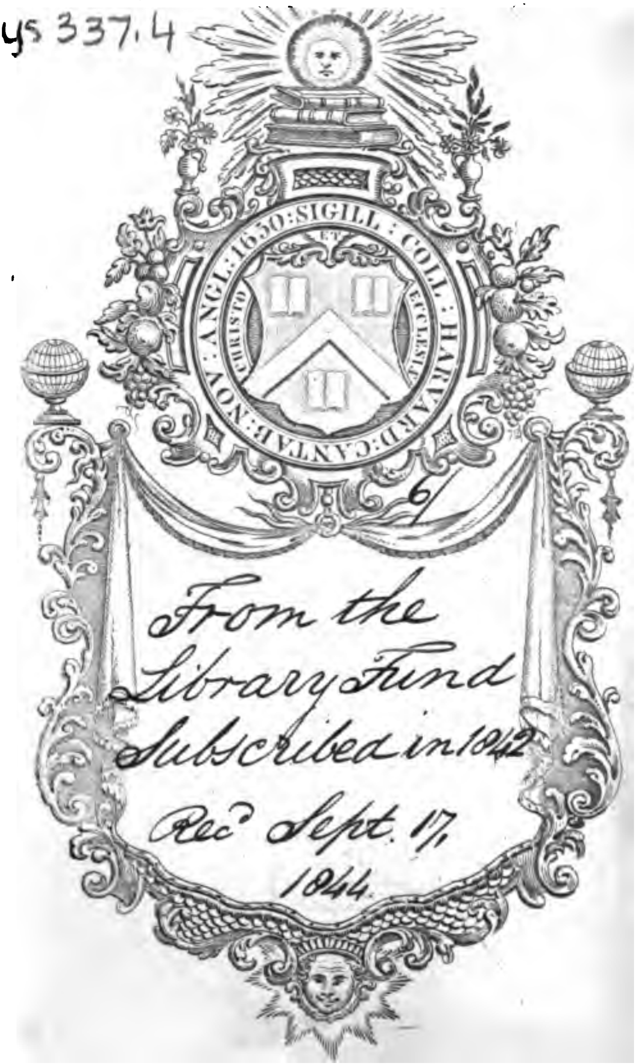

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ON

THE MOTIONS OF THE EARTH

AND

HEAVENLY BODIES,

AS EXPLAINABLE BY

ELECTRO-MAGNETIC ATTRACTION AND REPULSION,

AND ON

THE CONCEPTION, GROWTH, AND DECAY OF MAN,

AND

Cauſe and Treatment of his Diſeaſes,

AS REFERABLE TO

GALVANIC ACTION.

◆

Peter

BY P. CUNNINGHAM, SURGEON, R. N.,

AUTHOR OF "TWO YEARS IN NEW SOUTH WALES."

LONDON:
COCHRANE AND M'CRONE, WATERLOO-PLACE.
MDCCCXXXIV.

Phys 337.4

LONDON:

BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.

INTRODUCTION.

During my various voyages as surgeon-superintendent of a convict ship, the singular effects produced by the moon upon atmospheric vapours, and new-killed meat, naturally excited my curiosity; but, although the dispersion of fogs could be readily accounted for by the rarifying effects of her attractions, the cause of the decomposition of meat eluded my research until my return to New South Wales in 1828, when the extinguishing of the wood fires of the clearing parties there, by the moon's rays, showed the latter to consist principally of deoxidising rays, by whose oxygenous attraction putrefaction was accelerated, and combustion impeded. I published a short article thereon in the

Sydney Gazette, and had made some progress in a dissertation upon the identity of electricity and heat, when my recal into service diverted my attention to other pursuits, and the subject was no more thought of until some numbers of the United Service Journal, which fell into my hands in April, 1833, recalled my attention thereto, by a most interesting article which they contained, headed "The Occult Principle," evidently from the pleasing pen of Captain Basil Hall.

I was so sanguine of the identity of electricity and heat as to attempt the extraction of electric sparks from heated iron; but, while ruminating on the cause of failure, the recollection of positively electrified bodies *repelling* each other at once cleared up the point, seeing that as *masses* of electric matter thus repelled each other at *visible* distances, the *atoms* thereof must repel each other at *visible* distances also; these atoms, thus constituting the substance called heat, when at the visible repulsive distance, and the substance called lightning, when at the invisible attractive distance; the very fact of positive electric atoms existing in mass in lightning and in the electric jar, being a sufficient proof of their *attracting* each other when sufficiently near, in order to exist in that state.

Sir John Herschell's opinion relative to the changes in matter by electric currents, being most satisfactorily explained upon mathematical principles, by the theory of two distinct species of electricity, led me to investigate this point, and eventually to the identifying of negative electricity, magnetism, and the solar deoxidising rays as the same body; while the reverse polarities of bodies in the opposite hemispheres of the earth led again to the conclusion of a zone of mass-electricity surrounding the one, and a zone of mass-magnetism the other; the idea of a neutral line between electro-magnetic atoms occurring to me when endeavouring to explain the dissolution of chemical affinities by electro-magnetic currents.

The opposite electric and magnetic states of the northern and southern hemispheres of the earth, as well as of the poles of all bodies hitherto experimented on, naturally again led to the inference of an analogous state of the hemispheres of the sun, and consequently to the views relative to the motions of the planets and comets around the latter; while the idea of the difference of weight in the opposite hemispheres was suggested by the diverse colour of the moving and stationary sand in the desert near Arequipa (Peru), when accompanying Captain Charles Hope of H.M.S. Tyne, in an interesting excursion to that city.

While perusing Sir John Herschell's "Outlines," during the composition of my first Essay, the theory of Dr. Arnott's, therein referred to, of the brain being an electric battery, exciting, by its discharges, the heart and arteries to alternate dilatation and contraction, led to the views I have taken in the second Essay, as to all the changes in living animal and vegetable matter being referable to galvanic action. The manuscript of these Essays was forwarded to England in the latter end of June, since which I have added a considerable portion of new matter, so that the non-publication has enabled me to produce them in a more perfect state.

Thus a dissertation, commenced with the sole view of identifying electricity and heat as the same body, has been gradually expanded, as new lights were elicited, until made to embrace the explication of the greater portion of the most remarkable natural phenomena throughout the universe.

The leading views in these Essays may, indeed, be all analogically exemplied in the common experiments of the class-room,—the attractions and repulsions of positively and negatively electrified bodies, and of the opposite poles of magnetic needles, readily showing how the planetary and cometary motions may be effected by the similar attractions and repulsions of the hemispheres of the sun; and the decompositions and new arrangements of dead matter by galvanic currents, how living animal and vegetable bodies may be built up or destroyed by similar currents passing through them.

P. C.

H.M.S. Tyne,
January, 1834.

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ESSAY

I.

ELECTRICITY AND MAGNETISM.

HEAT and electricity are so analogous in their properties, as to have made it long suspected that the one is but a modification of the other. Good conductors of electricity are good conductors of heat, while bad conductors of electricity are bad conductors of heat. Wood, when dry, is a bad conductor of both, being made a good conductor of both when wet. Heat and electricity also are more readily attracted and conducted off by pointed bodies than by those not so; this being exemplified, as regards electricity, in the lightning conductors and the pointed attractors of the electrifying machine; and, as regards heat, in the more rapid heating and cooling of bodies in proportion to points on their surface. Water and air are bad conductors, but good carriers of both, evinced, as relates to electricity, in the rapid motion of electric clouds and winds, the elevation of sap in plants, and the overflowings of the sea, and of springs, during earthquakes.

Positive electric bodies repel each other; heated bodies do the same; both excite the sensation called heat; both are attracted by substances containing less, from substances containing more; both assist in furthering as well as in dissolving chemical affinities, in promoting combustion, fermentation, and putrefaction, and both are capable of exciting muscular contraction in the animal body when newly dead, as well as when in life: every cook seeing the latter frequently exemplified, as regards heat, in the contortions of eels, as well as in newly killed beef and mutton, when thrown in the hot frying-pan.

There are also such strong points of coincidence between negative electricity, magnetism, and the sun's deoxidising rays, as must strike the most common observer. Negatively electrified bodies repel each other; magnetised bodies do the same; negatively electrified bodies attract positively electrified bodies; magnetised bodies do the same; while negative electricity, magnets, and the deoxidising rays, have all a strong affinity for oxygen and its compounds the acids, reducing thereby metallic oxides to the state of pure metal, destroying vegetable colours, and separating various of the salts into their elementary constituents of acid and base.

The experiments of Morichini and Mrs. Somerville tend strongly to confirm the conclusion I have endeavoured to draw relative to the above identities, by finding that the sun's most refrangible beams, (in which the deoxidising rays are most intense,) conferred a magnetic property on bodies exposed to them fitted for receiving such an impression. The attractions, repulsions, and refrangibilities of positive electricity and of negative electricity are in fact so directly the reverse of each other, as to clearly point them out to be two distinct substances.

Positive electricity has a strong attraction for inflammable bodies, and thereby *promotes* combustion and the oxidation of metals; negative electricity has a strong affinity for oxygen, and thereby counteracts combustion and the oxidation of metals; they take *opposite* directions to each other in the galvanic trough, as well as in the electrifying machine having a negative wire, and when at the repulsive distance in the atomic state, as rays of heat and deoxidising rays, show *opposite* refrangibilities when a sun-beam is exposed to the influence of the glass prism.

The difference between the sun's heating rays and positive electricity, and between the sun's deoxidising rays and negative electricity or magnetism, can be readily explained by a reference to the attractions and repulsions of these bodies when forming *mass*. Positive electricity streaming in *mass* through the air in shape of lightning, being found in *mass* in the electrive jar, in the galvanic trough, and in (what are called) positively electrified bodies, distinctly proves that at near or *invisible* distances its atoms *attract* each other; while again the *visible* repulsion of positively electrified bodies, and of the southern poles of magnets for each other, as clearly proves that at more remote or *visible* distances, the atoms of positive electricity *repel* each other; for the attractions and repulsions of the *mass* must equally apply to the minutest atom thereof.

Negative electricity or magnetism exhibits similar results, its existence in mass showing an attraction of its atoms for each other at near or *invisible* distances; and the *visible* repulsion of negatively electrified or magnetised bodies for each other equally showing that its atoms at more remote or *visible* distances must *repel* each other. When the positive electric atoms, therefore, are at *invisible* distances, they *attract* each other, and form mass positive electricity, and when at *visible* distances, they repel each other and form what is called sensible heat; while in the same way, when the atoms of negative electricity are at *invisible* distances, they *attract* each other and form mass negative electricity or magnetism; and when at *visible* distances, they *repel* each other and form what are called deoxidising rays.

When the atoms of either, therefore, are at the repulsive distance, they will naturally fly off in all directions from each other, according as influenced by surrounding bodies, having an attraction for them; and being brought *gradually* in contact with these bodies by the diffusion of their atoms, their action upon them will be gradual also, and consequently mild, while the action of their mass will be sudden and consequently violent, by reason of both the suddenness and intensity of the application. It is only, therefore, by a forcing of these atoms at the repulsive distance into the attractive distance that a union of them, constituting mass, can be effected. The mere velocity of their motion in a a state of radiation may accomplish this, by causing them to mingle with the mass-electro-magnetism of the various bodies throughout the universe when coming in collision therewith; or it may be produced by artificial or natural condensation, the former being first effected by Sir James Hall, through the medium of the air-condensing syringe; while to the latter seems attributable the aurora borealis at the poles, in consequence of the sudden solidification of the oceans of water there. The attraction of electric atoms for each other, or of magnetic atoms for each other, seems, however, but weak in comparison to the attraction of electric atoms for magnetic atoms, as evinced by the rapid diminution in the cohesion of bodies, by the application of either intense heat or intense cold.

When the atoms of positive electricity are united together in mass, I will call this mass-electricity; and when at the repulsive state with each other, (constituting heat,) atomo-electricity; while deeming negative electricity, magnetism, and the deoxidising rays, the same body, I will call this mass-magnetism, when the atoms are united in mass, and atomo-magnetism when disunited or at the repulsive distance in shape of deoxidising rays.

Electricity and magnetism, however, follow reverse laws with regard to each other to what they do with their own individual atoms. Positively electric atoms, and negatively electric or magnetic atoms *attract* each other at *visible* distances, and repel each other at *invisible*; the former being exemplified in the visible attraction of positively and negatively electrified bodies for each other, and the latter in the opposite routes which the above atoms take in the galvanic trough, in their dissevering of chemical affinities, and in their diverse refrangibilities by the prism. There must be a point, however, between the attractive and repulsive forces, where the power of both being equally balanced, a body placed there will remain quiescent from being neither attracted or repelled; this point I will call the neutral line, from the opposing forces neutralising each other there.

It was predicted by Sir Humphrey Davy that the attraction and repulsion of bodies might hereafter be found referable to electric influence; and this we can readily conceive by simply applying the laws of electricity and magnetism in mass to the atoms thereof in chemical union with atoms of other matter. An electric atom combined with an atom of other matter will naturally attract a magnetic atom so combined, and by an accumulation of such a compound mass of matter will thus be formed either solid, fluid, or gaseous, according to the amount of electro-magnetic atoms in its composition. The electric and magnetic atoms will in fact approximate only to the neutral line, allowing thus always a degree of compressibility, elasticity, or mobility to exist in the compound bodies which they form, without the possibility of their atoms ever coming into actual contact on account of repulsion commencing between them when the neutral line is passed.

Electricity and magnetism thus appear in four different states. 1st. With the atoms united in *near* attraction forming mass-electricity and mass-magnetism. 2ndly. With the atoms at distant repulsion forming atomo-electricity or sensible heat, and atomo-magnetism or deoxidising rays. 3rdly. With the atoms quiescent in the neutral line with each other; and, 4thly, With the atoms chemically uniting atoms of other bodies to each other, in the latent or insensible state; for as a compound body retains few or none of the primitive properties of its constituents, so electricity and magnetism, when thus chemically united, must be less capable of exciting the actions and sensations produced by them when in a state of freedom. I may even add a fifth state, that is, their existence in mass in various bodies, which seems but a slighter species of chemical union, and in which state they can be expelled from these bodies by pressure, or extracted by other bodies having a stronger affinity for them.

ELECTRIC MACHINE.

HERE the electricity is seemingly evolved by pressure from the cushion; the mass electricity of the earth ascending by the connecting chain on each temporary removal of pressure, to supply the place of that evolved from the cushion; the electricity so evolved being carried round in an insulated state between the glass cylinder and the silk covering, (both non-conductors) until attracted by the iron points of the conductors into the insulating jar. This filling of the jar with electricity seems in fact a similar process to that of filling a receiver with condensed air by means of the forcing pump: the escape of electricity during its progress to the jar being as effectually prevented by the non-conductors it passes between, as the escape of the air is prevented by means of the pump valve.

GALVANISM.

HERE the electro-magnetism arising from the chemical decomposition of the plates, is evolved, I conceive, principally from that existing in *mass* therein; for their atoms chemically united with the plates would be naturally required in the formation of the oxide, or other compound, generated during the change of state in the metal. On the electricity and magnetism thus evolved, two opposite forces would be acting; viz. the attraction of the strongly combustible bodies, sulphur or hydrogen, for the electricity; and that of the least combustible or oxidisable metal for the magnetism. The electric and magnetic fluids set free, being thus directed in opposite currents toward their respective wires, eventually come in contact with the substances submitted for decomposition; when the electricity attracting the combustible base, and the magnetism the oxygen or its compounds the acids (according to the nature of the article) force the respective constituents asunder by the divellent force of their contrary moving currents, and carry them along in the neutral line toward the opposite wires. The cause of the negative metal not being oxidated during galvanic operations, seems assignable to the quantity of magnetism passing through it, which, having a stronger attraction than the metal for oxygen, consequently prevents the oxygen from acting on the metal.

COMBUSTION AND GUNPOWDER EXPLOSION.

HERE the heat evolved and expansion produced may be accounted for by the sudden conversion of the mass-electro-magnetism of the bodies decomposed into atomo-electro-magnetism. The heat evolved by percussion, or friction in air, or in vacuo, is explainable by the alternate condensations and expansions of the substances acted on; mass-electricity being forced out therefrom during each temporary condensation, and an equal quantity attracted from the other substances in contact, to supply the deficiency on the compressed substances again re-expanding.

The theory of a neutral line at an *invisible* distance between electric and magnetic atoms, seems fully borne out, by the discovery of a similar line at a *visible* distance between masses of such matter in cannon-balls, by Professor Barlow, which he designates "the line of no attraction," from the needle being neither attracted nor repelled in this line. The breadth of the neutral line, and the distance at which *near* repulsion commences between electricity and magnetism naturally increasing with the increase of the mass, furnish a sensible and natural key to the motions of all the heavenly bodies, while at the same time demonstrating the intimate union of the minutiæ of chemistry with the grander demonstrations of astronomical science, the line at which *near* repulsion commences between small masses of electric and magnetic matter being *invisible*, while between large masses of the same, as for example, between the earth and the sun, it is extended to upwards of *ninety* millions of miles.

MOTION OF THE EARTH.

If we place a bar of steel upon its end, or its side, in the northern hemisphere, we invariably find that magnetism occupies the *lower*, and electricity the *upper* part thereof; while in the southern hemisphere, electricity is found to occupy the *lower*, and magnetism the *upper*. By reference to the attractions and repulsions of electricity and magnetism, (previously stated) it will therefore be evident from this demonstration of hemispheric attraction and repulsion, that while a zone of mass-electricity envelopes the northern hemisphere, a similar zone of mass-magnetism envelopes the southern, regulating thus the electric and magnetic attractions and repulsions of bodies in these two hemispheres. Seeing that atomo-electricity and atomo-magnetism are radiated from the sun, we may conclude, that they exist there also in mass, and, by analogy with the earth, that the mass of each envelopes opposite hemispheres. The axes of the earth and sun being however on an average, nearly parallel with each other, it is evident that if their electric hemispheres were opposed on the one hand, and their magnetic hemispheres on the other, the earth would rebound from the sun, on account of the opposing hemispheres *repelling* each other; the sun's northern hemisphere therefore must be the magnetic, and his southern the electric, by which the opposing hemispheres of the earth will be *attracted;* and the earth consequently made to move round him in the neutral line. On her primarily approaching him, rotating upon her axis, her motion would be naturally unsteady; and supposing her southern hemisphere to be thereby more inclined to him than her northern hemisphere, the former from thus coming sooner into repulsion with him than the latter, would consequently be gradually canted outwards, which canting would turn her round in her course, in the same way as a carriage wheel is turned by a similar canting. Proceeding however still towards the sun, in consequence of her momentum of motion being as yet greater than the resistance opposed by his repulsion, she would finally arrive at the nearest point to which she could approach him, and be now repelled outwards from him as rapidly as she had been previously attracted. The southern hemisphere, however, from having a greater momentum given it, by reason of coming into repulsion with him before the northern, would consequently be made to come first in attraction with him also; through which this would be gradually canted toward him again, thereby turning her round afresh in her orbit, to pursue her former track.

To these alternate inclinations of the earth's hemispheres towards the sun, by the alternate canting outwards and inwards of her southern pole, we owe that charming variety in the year constituting the seasons, exhibiting to us a constantly-varying panorama of all that is delightful, mournful, or terrible in nature—the vibrations of her poles measuring out the march of the seasons with as beautiful a nicety as the vibrations of the pendulum measure out the march of time.

But each continued impulse thus given by the sun to the south pole of the earth in axillary rotation, will naturally keep up the latter, and by impelling her onwards at the same time, thereby whirl her round the sun in the area of her neutral line, in the same way as a carriage wheel is whirled round the area of a bowling-green. The earth approximating 2,754,000 miles nearer the sun during December, when her distance from him is least, than during the opposite month of June, when her distance from him is greatest, this space therefore marks the breadth of the path she is capable of moving in during her annual circuit.

In her course to and from the sun, she will, (as I have before stated,) in consequence of the impulse of motion previously given her, naturally proceed some distance into the repulsive and attractive spheres, before the counteracting powers of these spheres are enabled to check her onward motion and turn her round in the opposite direction. A retardation, therefore, of her onward motion from the above causes will take place between the autumnal equinox, and winter solstice, when she is proceeding into the repulsive sphere, and between the vernal equinox and summer solstice, when she is proceeding into the attractive sphere; while the above onward motion will, on the contrary, be accelerated between the winter solstice and vernal equinox, and between the summer solstice and autumnal equinox, from no counteracting causes then impeding her onward course.

During the periods, however, when her onward motion is retarded, her axillary motion will be naturally accelerated from her coming in oblique contact with the retarding power while in onward motion, in the same way as the rotation of a cannon ball would be naturally accelerated by striking obliquely against a substance when in onward motion, though the latter motion would be necessarily retarded thereby. That the accelerations and retardations of the above motions should continue uniform through the *whole* of their respective quarters is a circumstance rendered impossible by the natural laws of motion; the causes above alluded to naturally producing the above effects during a portion only of the said quarters. The moon and the various planets will necessarily also influence the earth's motion by their respective attractions and repulsions.

THE MOON.

As the moon moves round the earth, her hemispheres, in order to vibrate with the latter, must correspond with those of the sun, and be consequently *repulsed* by them. This solar repulsion, therefore, will naturally cause the moon to approximate nearer the earth than she otherwise would have done, when she passes between the latter and the sun, and to recede farther from the earth when the latter intervenes between. It will also tend to shorten the moon's angular vibrations, to quicken her motion when receding from, and retard it when advancing toward the sun, as well as to make her orbit more circular; and as she will be naturally propelled by the sun alternately toward the north and south poles of the earth, according as each of these in their season form the greatest angle with him, so this alternate change in her position will tend to produce warmer summers in these more polar regions than they otherwise would have experienced, had no moon revolved round the earth, by her attractions and repulsions causing the pole of the earth farthest from the sun to face still farther outwards from him, and consequently to cause the pole nearest to him to face still farther inwards, by which a fuller solar exposure, and thereby a greater summer heat, will necessarily be attained by these polar regions.

This solar propulsion of the moon alternately toward each of the earth's poles will conduce also to extend the moon's influence over a greater portion of the earth's hemispheres, than she could otherwise have embraced, had her circle of motion been confined strictly to the circle of the earth's equator, admitting thus the electro-magnetic zones, the atmospheric vapours, and the ocean involving the earth, to be all influenced to a greater extent by her. As the vibrations of the sun with the earth are between their south poles, it is probable from this that the vibrations of the moon with the earth are principally between their north poles, vibrations, that may in fact have occasioned those now existing, between the south poles of the earth and the sun, either from the moon accompanying the earth in vibration with the latter's north pole, (on the earth first approximating the sun) or from her approximating the earth after the latter had commenced her revolutions, and by sudden attraction with the earth's north pole, changing the vibrations of the sun and earth from their north to their south poles, had such a vibration as the former existed.

THE SUN.

THE luminous aspect of the sun as well as the heat radiated from his surface may as likely be produced by the influence of his electro-magnetic zone, as by combustion; the luminous aspect greatly resembling the deception called mirage, and probably ascribable to a similar cause; while the electro-magnetic particles would be readily attracted by, as well as repelled from, his electro-magnetic zone: according as their poles were situated with respect to his hemispheres. If, for instance, an electro-magnetic particle had its electric pole facing the sun, it would be attracted by the latter's magnetic hemisphere, and repelled by his electric, and *vice versa* if the particle's magnetic pole faced the sun. If, however, the poles of the particle were placed parallel to the poles of the sun, it would be attracted by both the sun's hemispheres, and thus be moved toward his equator to mingle with the electro-magnetic matter there.

As the poles of the electro-magnetic particles would be liable to be reversed by the attraction or repulsion of other passing particles, so by this frequent polar reversion of particles at the sun's surface, as well as through every portion of the heavens, a constant radiation of atomo-electro-magnetism to and from the sun would be kept up, the particle just attracted by him being liable the next moment, by a change of its poles, to be repelled from him, and to be attracted back again on another polar reversion taking place.

As the sun's rays always excite the sensation of heat, and never that of cold, it may consequently be inferred that electric atoms preponderate over magnetic atoms in his rays, by which it might be inferred also that, provided the preceding theory be correct, the electro magnetic particles would be attracted solely by his magnetic hemisphere, and repelled solely by his electric. That the electro-magnetic particles may be attracted by and repelled from the sun, in the ways previously stated, is sufficiently illustrated on a grand scale (as I shall afterwards show) by the motions of comets,—bodies similarly constituted of electro-magnetism, which are attracted to the sun by one hemisphere and repelled from him by the other, on their passing from the first into the latter.

That the sun should be the only body within the heavenly hemisphere capable of giving out heat may be readily accounted for, by his attractive power being so much greater than that of any of the others, as evinced in the comets passing all of them, to proceed to him, while his greater propulsive power is similarly exemplified in his giving such a rapidity of motion to the electro-magnetic particles repelled from him, as well as to the masses thereof forming comets, as to neutralise in a great measure the attractions of all the planets they do not pass toward in a direct line; only yielding to the planetary attractions when their motion is greatly retarded by their distance from the sun, or when moving as above toward them in a direct, or at least, nearly direct line.

As we naturally conclude, however, that the solar rays contain electricity in excess, from their always exciting the sensation called heat, how is it that the northern or electric hemisphere of the earth, which repulses electric matter, should be as warm as the southern or magnetic hemisphere, which attracts it? Can this be owing to the electro-magnetic particles propelled from the sun overcoming, by the velocity of their motion, the resistance opposed by the electric hemisphere, or to a magnetic atom being insufficient to neutralise the influence of an electric atom, as far at least as the sensation called heat is concerned? This sensation may indeed be only a feeling produced by electric particles in *motion*, which they are incapable of producing when at *rest*, by reason of the similar motion they will naturally excite among the particles of the matter which they come in contact with. Electricity or heat, producing expansion, and magnetism or cold, contraction, these two opposite actions among the particles may, therefore, excite the opposite sensations which they produce.

Judging, however, by the appearances which the earth now presents, of her having been formerly in a state of combustion, we may infer that the sun has at least formerly been in a similar state; and as many portions of the earth are at the present day in combustion, we may also infer that many portions of the sun are still in a similar state also, his greater bulk not only affording more combustible food, but requiring an infinitely longer period to cool in.

In the event of the continuity of either the electric or magnetic zones of the sun being partially destroyed by any volcanic or other violent eruption, the breaches so made would no longer attract the electro-magnetic particles, and consequently would appear of a dark hue; and this may probably be the explanation of the dark spots frequently visible on the sun's surface.

This view seems corroborated by these spots becoming more angular toward the south, when the earth is in attraction with the sun's southern hemisphere, and more arched again in the same place in repulsion, the earth's attraction naturally drawing the sides of the spots toward a point in the line of the greatest attraction, and her repulsion forcing them out asunder again. Calculating by the period of three hours, required by the moon to raise a tide upon the earth, the earth, according to her greater comparative distance from the sun, ought to produce her greatest effect upon the solar spots in forty-nine days after the solstices, whereas she does not do so until about seventy days after the solstices. As spring tides, however, do not take place until twenty-seven hours after the sun and moon have been in opposition or conjunction with each other, I am consequently inclined to think that the impulse of the moon's attraction or repulsion requires twenty-seven hours at least to manifest itself upon the earth, which, by comparison of distance, would give the earth one year and seventy days after each solstice to manifest her greatest influence upon the solar spots, making this therefore take place about the 1st of March and the 1st of April in each year, the identical time that observations have ascertained it to happen. This would tend to show that attraction and repulsion are not instantaneous, but progressive, while corresponding in *uniformity* to the motion of the heavenly bodies, describing equal spaces in equal times, at the rate of about 147 miles a minute.

Can the effects of attraction and repulsion be ascribable to a power inherent in a body which it can exert upon another body at a distance, or to a substance in motion exerting an effect by actual contact? If the latter be the power, atomo-electro-magnetism seems the most probable substance causing the before-mentioned effects. But the immense known rapidity of motion of the atomo-electro-magnetism radiated from the sun does not correspond with the slow motion of the influence producing the changes in the solar spots and the tides, though they both agree in the comparative tardiness of their effects; for if the earth does not produce her greatest effects upon the solar spots until seventy days after each solstice, it is just about the same period that the sun produces his greatest heat and greatest cold upon the reverse hemispheres of the earth, after having emitted it intensely to the one turned toward him, and extracted it intensely from the one turned from him. As the mass electro-magnetism of the sun's zones must have, however, a westerly motion given to it by the revolving planets, the solar spots must consequently partake of this motion, seeing, by their frequent disappearances and re-appearances, that they are but temporary breaches therein; so that the actual period of the sun's rotation will necessarily be greater than that ascribed to it, through observations upon the period of the spots' rotation.

The rotation of the various planets round the sun will naturally turn him upon his axis, while their hemispheric attractions and repulsions will excite also angular vibration in his poles, conferring thus a similar variety of days and of seasons upon him that he confers upon them.

PLANETS.

All the planets moving from west to east round the sun, renders it evident that their hemispheres are similarly constituted, of electric and magnetic matter, and that those hemispheres correspond in their opposition to the sun to those of the earth, their northern being electric and their southern magnetic; all, however, necessarily containing an increased amount of mass-electro-magnetism in their hemispheres, not according to their increased size, but according to their increased distance from the sun, by which their reciprocal distances from the latter are preserved. But each increase of mass-electro-magnetism, while increasing their distances from the sun, and consequently the extent of their orbits, will also proportionally increase the breadth of the neutral line, and consequently the length of the ellipsis; and if not containing equal portions of electro-magnetism in their hemispheres, or unaccompanied by moons, will give also a greater angularity of motion in this ellipsis. Thus the small planets, Juno, Vesta, Pallas, and Ceres, show, by their nearly triple distance from the sun, to what the earth is, that they contain nearly triple the latter's amount of mass-electro-magnetism, by which the breadth of their neutral line, and their elliptic orbit will be made nearly triple the extent of hers.

The motions of comets, as well as of the minutest particles of electro-magnetic matter propelled from the sun, being diminished in proportion as they progress outward from that luminary, renders them consequently more liable to be attracted by the distant planets than by the near; hence the number of moons which the distant planets possess, and hence also the possibility of these distant planets being as warm as the near, not only from their greater mass of electro-magnetism possessing a greater attraction for electro-magnetic particles, but from their greater power of attracting the latter in consequence of their diminished motion.

The attraction and repulsion of these moons with the hemispheres of the above distant planets, provided they are equally divided between the two hemispheres, will necessarily tend to shorten the extent of the planets' polar vibrations, and thus preserve a greater uniformity of season in them than in the planets destitute of such moons. This very shortening of their vibrations, however, will accelerate their axillary rotation, while the attractions and repulsions of the moons, operating equally at the same time round every part of their circumference, will necessarily tend also to retard their onward motion, which would otherwise have been accelerated by their increased axillary motion.

As attraction and repulsion increase in a body in proportion to the amount of mass-electro-magnetism it contains relative to its bulk, therefore Uranus may be a warmer planet than Jupiter, though nearly four times his distance from the sun, in consequence of being only one-third his size, while containing nearly four times his amount of electro-magnetism, as evinced by being nearly four times his distance from the sun. The rings of Saturn seem to be composed of alternate strata of electric and magnetic matter, the dark line between marking the situation of their neutral line.

Viewing the sun as the great centre of electro-magnetic attraction and repulsion in the sphere in which our earth is placed; that planets move round him under the above influences at the distance of eighteen hundred millions of miles; and that comets, repelled outwards still further, are attracted back again to him; we may therefore presume that but few of the electro-magnetic particles radiated from him pass beyond the limits of his attractions, while the loss of even these few will in all likelihood be replaced by electro-magnetic particles radiated from other bodies similar to himself.

From the apparent effect of Jupiter's satellites in shortening his polar vibrations, it would appear that what our earth would gain in light, by the addition of another moon, she would lose in the polar extensions of her summer, by which the more polar portions of her surface, now habitable, would be rendered unfit for human existence. As some of the planets will necessarily vibrate with the sun's northern hemisphere, and others with his southern, this will naturally produce some variety in the inclination of their orbits to him, particularly among the smaller ones, containing a large amount of electro-magnetism in a small bulk. To the above causes may be owing the singularity in the orbits of Ceres and Pallas; for should they both describe the same-sized orbit, vibrate with different poles of the sun, and come into near repulsion and distant attraction with him at different periods, they would naturally pass each other in their orbits, and by the smallness of their volumes, probably moving also more outward in the directions of the sun's poles than the larger planets, would thus exhibit a greater singularity in their motions than the latter.

All the planets having necessarily an axillary rotation, in order to move round the sun in the manner they do, this rotation will consequently counteract the attraction of the sun upon their electro-magnetic matter, and thereby prevent its being expanded outwards, like the electro-magnetic matter of comets.

The onward and axillary motion of all the primary planets round the sun must be similarly alternately accelerated and retarded like those of the earth, while the secondary must be similarly influenced in the above motions round the primary, besides having these motions also influenced by the repulsion of the sun, in the manner exemplified relative to the motions of the moon. Should any planet, whether primary or secondary, contain equal portions of mass-electricity, and mass-magnetism, in its respective hemispheres, the hemisphere that first vibrated with the corresponding one of the body round which it revolved, would still be disposed to continue an exclusive vibration therewith, by the impulse exclusively given to it bringing it always into earlier attractions and repulsions with the body round which it revolved than the opposite hemisphere; but I conceive that the earth, and other planets possessing much angular motion, derive this principally from their containing unequal quantities of electricity and magnetism in their hemispheres, through which the hemisphere containing the largest quantity will naturally be more powerfully attracted and repelled by the sun or planet round which it revolves, and thereby ensure the continuance of its exclusive vibrations with the latter. By recorded astronomical observations of ancient times, it appears that the northern and southern summers were formerly of equal duration; whereas the northern now exceeds the southern by upwards of seven days, which I conceive could have only been produced by a decrease of mass-electricity in the earth's northern hemisphere, an increase of mass-magnetism in her southern, or a similar increase or decrease thereof in one of the hemispheres of the sun: because, when the summers were equal in both hemispheres of the earth, both of these must have either simultaneously or alternately vibrated with the sun: in the first case, causing equal days and seasons to prevail throughout the year over the similar opposite latitudes of the earth; and in the second, changing the northern summer into one of repulsion with the sun, like the present southern summer. The above reasoning seems warranted from the circle of attraction being necessarily larger than the circle of repulsion, on account of its being exterior thereto; so that the hemisphere of the earth enjoying summer during the period of attraction, must necessarily have that summer longer than the hemisphere so enjoying it during the period of repulsion.

The progressive electro-magnetic increase in the above hemispheres would, however, by increasing the size of the earth's orbit, necessarily cause a similar increase in the length of the year, which astronomical observations do not confirm, unless the above has eluded notice, from the earth's rotation being at the same time diminished, through which the year might be retained of the same length as to number of days by the increase thus made in the length of each day. This diminution of axillary rotation in proportion to the increased angularity of the planets' motions, seems in some measure borne out by the primary planets of least angularity having the most rapid axillary motion, a result necessarily produced from this axillary motion being given to them through the resistance alternately opposed to their onward course by the attractions and repulsions of the sun, as previously exemplified in the case of the earth; so that when *both* hemispheres of a planet are equally influenced thereby, the double resistance thus opposed will consequently *double* the axillary rotation. Though this reasoning will, I conceive, hold good as far as relates to any individual planet, yet it cannot possibly be applicable in a comparative degree to all, unless the forms of all be precisely similar, which we have not means of deciding. The slow axillary motion of the moon, though she possesses but a small angularity, may be deemed to contradict the above; but it must be evident that the axillary rotation which she derives from the attractions and repulsions of the earth, operating upon one side of her, will naturally be counteracted by the repulsion of the sun operating upon the other. But the cause by which the diminished axillary motion of the earth was effected would operate also in diminishing her onward motion, a result which the increase observed to have taken place in the earth's equinoctial precessions (when comparing ancient observations with those of later times) seems to warrant, from any diminution of her onward motion naturally tending to produce this result. Should an increase have taken place since ancient times in the mass-electro-magnetism of the sun, all the planets must have receded from him; while, if an increase has taken place in the mass-magnetism of the earth, this may probably be imputable to the atomo-magnetism reflected by the moon. The great eccentricities in the orbits of the small planets, may be owing to the above unequal quantities of electric and magnetic matter in their hemispheres.

A progressive annual diminution in the extent of the earth's angular motions has for a considerable period been noted by astronomers, and which I conceive imputable to the diminution that has been taking place during the same period in the mass-electro-magnetism of the moon, as evinced by the progressive annual diminution of the time in which she describes her orbit, through the contraction of the latter, in consequence of her nearer approximation to the earth. Always revolving round the hemisphere of the earth farthest from the sun, her own attractions and repulsions upon this hemisphere, combined with the sun's repulsion upon her, would naturally tend to *increase* the earth's angularity; and consequently, any diminution in the moon's electro-magnetic power would necessarily tend to *diminish* it.

COMETS.

THE appearance as well as the movement of comets favour the supposition of their being constituted wholly or partially of electro-magnetic matter, all the varieties of them which I conceive capable of existing being the following:—1st. Those composed of either mass-electricity or mass-magnetism only. 2dly. Those composed of both these bodies. 3dly. Those composed of matter like our earth, with similar electro-magnetic hemispheres surrounding them. The first I would call simple comets; the second, compound; and the third, complex. Now supposing a comet composed solely of mass-electricity, within attractive distance of the sun's magnetic hemisphere, the comet being the smallest body would naturally be moved towards the latter, its motion increasing as it approached from the sun's increasing attraction, until arrived within *near* repulsion of his magnetic hemisphere, when its onward course being thereby checked, it would now move round the latter in the area of the neutral line. Should its motion be in the direction of the sun's equator, it would now cross this, and consequently come in opposition with the sun's electric hemisphere, from which it would be as powerfully repulsed as it had been previously powerfully attracted by the opposite hemisphere of the sun. Progressing on its outward course, its motion would become slower and slower, until coming again in the line of attraction of the sun's magnetic hemisphere, it would be gradually drawn round toward the latter, and finally attracted back thereto, to follow up afresh its former track.

This species of comet being equally attracted by one hemisphere, and equally repelled by the other, will have a smaller tail than the other comets, if moving like an arrow; and none at all, if rotating on its axis; while comets composed solely of magnetism will necessarily be attracted by the sun's electric hemisphere, and repelled by his magnetic.

The theory of the motions of compound comets is somewhat more complex. Being constituted of both electricity and magnetism, these two bodies will naturally form separate hemispheres therein, as they do in all other bodies; and supposing therefore a compound comet with its electric hemisphere within attractive distance of the sun's magnetic hemisphere, it would consequently move toward the latter, and as it approximated its magnetic atmosphere would be repelled outward in shape of a tail by the repulsion of the sun's magnetic hemisphere, towards which its electric head was attracted. Passing round the neutral line area of the sun's magnetic hemisphere, and crossing the latter's equator into the limits of his electric hemisphere, it would now be repelled off, by the latter, in the same way as the simple comet; the interposition of the comet's electric head between its tail and the sun, counteracting the attraction of the latter upon the tail, and thus enabling the comet to proceed in its outward course until its electric head came again within the attractive limits of the sun's magnetic hemisphere, to be moved back thereto.

Compound comets, with their magnetic head toward the sun, will necessarily be attracted by his electric hemisphere, and repelled by his magnetic; while complex comets will conform to the motions of one or the other before described.

Simple comets will be more rapid in their motion than compound ones, of even double their size, from the tail of the latter impeding the onward motion of the head, by its repulsion of the sun on the comet's approximating the latter, and its attraction on the comets receding therefrom. The motion of comets will be retarded in passing round the attractive hemisphere of the sun by the attraction thereof; and the greater the extent of this they have to pass round, the greater consequently will be their retardation, the latter being necessarily greatest at the period of the comet's expulsion.

The smaller simple and compound comets are, the smaller will be their orbits, and the nearer will they approach the sun: simple comets necessarily describing larger areas, or orbits, than compound ones of even double their magnitude.

A comet, on nearing the sun, will have its central attraction diminished by the sun's attraction, and its matter will consequently expand outwards, in proportion as it nears the sun, but be rapidly condensed again on repulsion from the latter. The tail of the compound and the complex comet will undergo a similar expansion and diminution from the same causes, streaming directly outwards, from the sun, when the comet's motion is slow and inclined more and more toward the line of the head's course according to the rapidity of that motion, or even deflected toward the sun when influenced by the opposite hemisphere to that by which the head is attracted. The dark line in the tail, supposed to be the shadow, is doubtless the neutral line dividing the two hemispheres of the comet.

When a comet has a plurality of tails they will diverge from each other, in consequence of their being all necessarily at the repulsive distance, in order to admit of such a plurality existing. As there is, however, every probability of comets containing unequal portions of electricity and magnetism in their hemispheres, the hemisphere containing the largest amount will naturally be the one attracted by the sun, so that the smaller the hemisphere composing the tail the more rapid will necessarily be the comet's motions to or from the sun. When the electricity and magnetism of compound comets are nearly balanced, the great retardation necessarily thus caused in the comet's motion toward the sun by the repulsion of the tail might occasion a tail-shaped stream to be projected from the comet's head toward the sun, through the influence of the latter's attraction; while, again, if a portion of the tail happened to be shifted toward the sun when the comet passed into the latter's repulsive hemisphere, a tail would naturally be projected toward the sun on departure also.

Magnetic atoms will be attracted by the comet's electric hemisphere, and electric atoms by its magnetic, tending thus to increase the volumes of both the head and the tail, particularly when near the sun, where these atoms most abound.

The body of a comet being in itself incapable of imparting heat except by contact, whatever heat therefore it gives out it must *first* attract from the sun or other bodies, and consequently cold is more likely to be produced by its presence than heat. The rapid motion of a comet on approaching the sun, by diminishing the central attraction of its matter, will enable portions of the latter (particularly that of the tail) to be more easily dissevered by the attraction of the sun and other bodies near which it may pass. From this source I conceive it likely that the sun and the planetary bodies may derive portions of mass-electro-magnetism, in this way re-supplying the waste of that produced by the chemical galvanic actions constantly going on in them. We frequently see matter of this description under the name of meteors, streaming toward the earth, their velocity progressively increasing with their approach, and by this increase of velocity progressively diminishing the meteor's central attraction, until its whole substance is scattered in its course in a long train of luminous particles.

Comets, when composed *entirely* of electro-magnetic matter, must not be compared with the planetary bodies, as to their attractive and repulsive powers, according to their relative magnitudes, but according to the comparative amount of mass-electro-magnetism contained in each. A comet, therefore, though only a fraction of the magnitude of our earth, may contain more electro-magnetism than the latter, and consequently be unable to approximate so near the sun.

The revolution of comets will naturally be affected by the attractions and repulsions of such planets and comets as they may pass near in their course, while the axillary motion and polar vibration of the sun will cause a constant variation in the place where they first approximate him. Their revolutionary periods may also be shortened or lengthened, and they may change their orbits or disappear in the following manner:—1st. By the attraction of the hemisphere whence repulsed, or by that of planets or other comets, the *tail* may become the *head*, and the comet consequently be attracted back to the sun's hemisphere, from whence it had just been repelled, in which way only do I conceive it possible for a comet to encircle the sun. 2ndly. The greater the extent of the neutral line it has to pass through in the sun's attractive hemisphere, the longer will be the period of its revolution, and *vice* *versa*, the shorter. 3dly. The more rapid the comet's motion on crossing the sun's equator, the farther will it proceed upon the repulsive hemisphere before its expulsion; the longer consequently will the repulsive hemisphere's actions continue; and the longer therefore will the comet be in returning to the sun. 4thly. Should a comet, by the velocity of its motion pass for a considerable distance over the sun's repulsive hemisphere before being repelled, it might be repelled off in such a line as never to come within the attraction of his other hemisphere, and be thus moved into illimitable space, there to remain motionless, or coming within the attractive sphere of some other planetary system, be drawn thereto. 5thly. If a comet first approximated the sun's attractive hemisphere near his equator, the greater rapidity of its motion from this cause, on crossing this equator, as well as its inclination towards the sun's repulsive hemisphere, might be sufficient to impel it within the *near* attraction of the *sui generis* matter of the latter, and enable it to mingle therewith. 6thly. A compound comet having its hemispheres placed parallel by planetary or cometary influence with the attractive hemispheres of the sun, would be rapidly drawn in axillary rotation toward the latter, and move round it as a planet; but should the repulsive hemispheres of each be opposed it would be repelled into illimitable space. 7thly. Comets may have their motion so retarded by the distance they have to pass over in the sun's attractive hemisphere as at last to become motionless and remain thus as a fixed star; in this or in some other of the ways before described, many of the stars are probably retained in their situations.

The only comet that can approach the sun in a line perpendicular to his equator is the compound or complex comet before spoken of, with its poles parallel to those of the sun; all the others being obliged to pass obliquely thereto, while none will be able to pass within the earth's orbit unless their mass-electro-magnetism be less than that of the earth.

A comet in approaching near the earth may affect it in the following ways:—1st. It may change the position of the earth's poles, and thus render the present temperate inhabitable parts no longer so, and the cold uninhabitable fit for the production of every thing connected with the sustenance of man. 2dly. It may by a similar near approximation cause a partial deluge. 3dly. It may cause the northern hemisphere of the earth to vibrate with that of the sun, and thereby reverse the seasons, changing the present summer months into winter, and the present winter months into summer. 4thly. It may force itself into near attraction with the mass-electricity or magnetism of the earth, and mingle therewith in the manner stated with respect to the sun. 5thly. It may cause such a sudden change in the electro-magnetic hemispheres as to bring them in repulsion with the sun, and thereby cause the earth to be repelled therefrom like a comet. It may be doubted whether the approximation of a comet can effect any important change on the earth, seeing that its mass-electro-magnetism must be smaller than the earth's to be enabled to pass within the latter's orbit, and that the attractions and repulsions of that immensely larger body the sun produce no disasters upon her. It must be recollected however that the sun is never permitted to exert a very powerful attraction or repulsion upon the earth, in consequence of her being always moved back again in a contrary direction, before either of the above can be intensely exerted. Neither is the entanglement of the comet of 1770 among Jupiter's satellites without deranging their positions or motions, any better example to judge from: in consequence of the comet's motion being here greatly diminished by reason of its great distance from the sun, while in approximating the earth its motion on the contrary would be greatly increased, rendering it thereby more liable to be forced into violent collision with her.

STARS.

The stars never changing their figure like the moon and other planets deriving their light from the sun, are consequently supposed to be suns shining by their own light, while the little or no variation in their positions, with respect to the sun, establishes their attractions and repulsions as connected with those of the latter. From this it is evident that the *nearest* stars at least have their magnetic hemispheres opposed in the neutral line to the sun's electric hemisphere, or their electric to his magnetic, by which the above fixation is effected, for were both the attractive hemispheres of these near stars opposed to those of the sun, a vibration would take place between them, and the smallest would consequently move round the largest as a planet.

By *one* pole only of the *nearest* stars being opposed to the sun, a congeries of stars might be in this way attached round both his hemispheres without materially affecting each other's position, for while retained in their relative distance with the sun by the latter's attraction, they would be retained in their relative positions with each other, by the repulsions or attractions of their own opposing hemispheres.

To the hemispheres of the above stars directed outwards from the sun, another congeries of stars might be similarly attached, and so on congeries after congeries extending through space, either attached as above to one single star, or to the hemispheres of the two nearest adjoining, all retained in their relative position by their finely-balanced attractions and repulsions with each other. Planets might also readily revolve round many of these stars, because while the hemispheres of the planet were attracted by those of the stars, they might be so situated with respect to the opposing hemispheres of the other stars as to be repelled by them, as those of the moon are by those of the sun.

The vibration of the poles of the sun will tend to produce some slight change of position of the stars in attraction with him, and in a similar way the position of small stars in attraction with large may be affected by the polar vibrations of the latter. New stars will be naturally more unsettled in this respect than the old, before they have attained a balanced position among the latter, and be also more liable to disappear than the old, because, should they pass the equator of the body with which they are in attraction (*i. e.* if to a single star or to the sun,) they will come within the influence of its repulsive hemisphere, and thus be propelled outwards into the heavens, or inwards toward thesun, to approach the latter as a comet or a planet, should their attractive hemispheres be opposed.

HEMISPHERIC ATTRACTION AND REPULSION.

THE effects previously described of the hemispheric attractions and repulsions upon the mass-electricity and magnetism in the steel bar, show that these two bodies form an immense ocean, encircling the superficies of the respective hemispheres of the earth. The attraction of these bodies for each other, the rotation of the earth, as well as the westerly motion necessarily given them by the attractions and repulsions of the sun and moon, will naturally produce a greater accumulation of their matter toward the equator, and a progressive diminution thereof from the latter to the poles.

This equatorial accumulation seems fully verified by the swinging of the pendulum. A bar of steel, for instance, as before illustrated, whether placed on its side or its end in the northern or electric hemisphere, will always have its mass-magnetism occupying the lower part, and its mass-electricity the upper, whichever way it be shifted. Now, taking this bar and swinging it as a pendulum in the electric hemisphere, it will be evident that as the end of it rises from the earth its electric current will flow toward its *upper* side, and its magnetic current toward its *under* side, and the farther the pendulum swings, the farther will the magnetic current run along this under side, thereby increasing its power as a lever, and enabling the attraction of the electric hemisphere to pull it back again with more ease to the earth, to whichever side it may swing. Now, it is also evident, that as the attractive power of the hemisphere increased, the vibrations of the pendulum will be shortened, as well as retarded by the increasing attractive power not only pulling it quicker and quicker down, but binding it also down with stronger and stronger grasp toward the earth. To retain, therefore, the pendulum's vibrations uniformly equal in an equal arc over every part of the earth, it follows from the above that as the attractive power of the earth *increases* we must *decrease* the power of the lever, and hence the necessity of progressively shortening the pendulums of clocks, as we advance from the pole toward the equator, where the greatest attractive power exists. But attraction being weight, bodies, therefore, must be *weightiest* near the equator, and were it possible to construct a needle with one pole only, it must also follow that, provided there be no electro-

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magnetic current, it would point to the equator in both hemispheres, if it pointed horizontally any where, and hence also the heaviest metals, such as lead, gold, and platina, would seem best fitted for magnetic needles.

It may be objected to this view, that as the poles of the needle dip more and more in their respective hemispheres as we progress either north or south from the equator, this increase of dip would consequently seem to argue an increase of attraction, instead of a diminution thereof. It must be evident, however, that as we advance from the equator toward the north the attraction of the earth's southern magnetic zone for the south point of the needle will be progressively diminished, thereby admitting the repulsion of the northern electric zone to tilt more readily the south point of the needle upwards, and consequently cause a progressive dip of the north point; the latter point being the one necessarily tilted upwards in the southern hemisphere, and the south point the one which dips.

The opposite attractions and repulsions of the respective northern and southern hemispheres, must also cause the weights used, and articles weighed in them, to vary in weight, according as electricity or magnetism predominate in the said weights or articles. Thus, if a weight, or an article weighed, contains more mass-electricity than mass-magnetism, it will weigh heavier in the southern hemisphere than in the northern, and *vice versâ*, if containing more mass-magnetism than mass-electricity, a circumstance which must frequently cause a difference of weight in the respective hemispheres, in articles exported from the one to the other.

The difference of custom-house weight, often observed between the article when shipped and when landed, has been hitherto ascribed to the absorption or exhalation of moisture during the voyage, according as an increase or deficiency of weight was found to exist; but it may be as likely owing to the absorption or exhalation of electricity or magnetism, if I may use such expressions, or to the different amounts of these bodies in the article when shipped,—when transported in the latter case from one hemisphere to the other. In corroboration of this point there is evidently a reverse of weight in particular coloured sands in the two hemispheres; thus, in the northern African desert the moving sand-hills and flying sand are of a dusky red, and the more immoveable sands of a white or leaden colour; while in the southern deserts of America the reverse is the case, showing thus a reverse weight in each species of sand in these opposite hemispheres. What can this singular circumstance be attributed to, except that of the red sand containing electricity in excess like the sun's red rays, and the pale sand magnetism in excess like his pale rays. The above is one of the many links tending to prove the sun's rays to be compounded of various proportioned electro-magnetic atoms; his most electric rays being the reddest, and his most magnetic rays the palest, while the rays between the two partake of a progressive or retrogressive scale of refrangibility or heat, according as we advance from either extreme of the rainbow-fan into which the sun's rays are expanded by the glass prism. Nearly all the chemical experiments having been hitherto made in the northern hemisphere, sufficiently accounts for any difference of weight that may exist between similar articles weighed in both the hemispheres having been hitherto unnoticed.

TIDES, AND VARIATION AND DIP OF NEEDLE.

The tides in the northern hemisphere being on an average higher than those in the southern, lend a probability to the supposition of the moon vibrating principally with the former,—and to the moon's influence upon the tides in the northern hemisphere I confine my observations. When the moon is in repulsion with the earth, her pressure upon the ocean will naturally cause a hollow therein, and by reason of the earth's diurnal motion the westernmost of the two ridges of waters constituting the hollow will be forced backward toward the west in shape of a tide; when, however, the moon is in attraction with the earth, this attraction will lift up the waters directly under her, and through means of the earth's rotation cause a westerly moving tide also. The moon's pressure upon the earth again during repulsion operating indirectly upon every particle throughout the latter, will necessarily cause a similar westerly moving tide on the opposite side of the earth, while by her lifting upward during attraction of the matter of the electro-magnetic zone directly under her, she will cause a similar westerly moving tide on the opposite side of the earth, in consequence of the electro-magnetic matter being diminished in amount at this point proportionate to the accumulation of it at the other, admitting thereby the waters there to be more readily propelled outward through the centrifugal influence of the earth's rotation. Were the tides produced by the influence of the moon alone, they would necessarily be highest when she was at the points of greatest attraction and greatest repulsion, that is, when farthest from and nearest to the earth; but the sun, by reason of his greater size, exerting a greater attraction and repulsion upon the latter than the moon, consequently counteracts the moon's action in the elevation of the waters, when their respective influences are opposed to each other in the effecting of this object; and hence the highest tides are produced when their influences correspond, that is, when they both operate upon the same part of the ocean when in conjunction, or on opposite parts thereof when in opposition. That the solar tide should be but little perceptible, while the lunar tide, on the contrary, is so prominently marked, is doubtless referable to the much greater size of the sun than the moon; so that his attractions and repulsions embracing an infinitely greater portion of the ocean's superficies, the elevations and depressions of of the waters will be consequently rendered infinitely less apparent, from the great superficial extent of them thus acted upon at the same instant. The tides from repulsion must, I conceive, be generally higher than those from attraction, on account of the moon, in the latter instance, having to contend against the earth's attraction in the elevation of the waters; while the tide on the opposite side of the earth must be naturally lower than that under the moon, on account of the greater distance at which her influence is exerted. The highest spring-tides will, I conceive, be those when the sun and moon are in conjunction, and at their greatest repulsion with the earth; the next highest when the moon is at greatest repulsion, and the sun at attraction with the earth, and both in conjunction as before; while the lowest spring-tides will necessarily be those where the moon and sun are in neutral lines with the north, and in opposition to each other; and the next lowest species when they are both at greatest attraction with the earth, and in opposition to each other, because their opposing attractions, by diminishing the density of the electro-magnetic zone at the points of the earth between them will, I conceive, thereby enable the earth's centrifugal force to bulge out the waters there, and consequently counteract the elevation of them at the places directly opposed to the sun and moon.

The lowest neap-tides will, I conceive, also be those where the sun and moon are in the neutral line with the earth; and the highest when they are in greatest repulsion with her, at that period of the moon's quarters when the above tides take place.

The foregoing deductions I have made somewhat at hazard, it being difficult to decide by inductive reasoning alone what effects the complicated influence of the sol-lunar attractions and repulsions may produce upon fluid matter exposed thereto in various positions. The earth's southern hemisphere vibrating with the sun, the latter will have consequently greater influence over the waters there than in the earth's northern hemisphere; his pressure, however, during repulsion (the northern winter), by forcing the waters of the southern hemisphere into the northern, will necessarily produce higher seas and tides in the latter than in the former; while his lifting up again, as it were, of the southern waters during attraction (the northern summer) will draw those of the northern hemisphere into the southern, and thereby produce higher seas and tides in the southern hemisphere than in the northern; the moon naturally tending to increase the above in consequence of being always propelled into the wintry hemisphere through the sun's repulsive influence upon her.

The attractions and repulsions of the sun and moon upon the earth will, by reason also of the easterly movement of the latter, produce a westerly-setting tide and current in the great electro-magnetic ocean surrounding her; the tides causing by their attraction a little easterly variation of the needle at the rising, and a little westerly variation at the setting of these luminaries, while the current caused by them will tend to produce a permanent westerly variation of the north point of the needle in the northern hemisphere, and a similar westerly variation of the south point in the southern hemisphere, in consequence of the passing atoms of the current attracting the respective points of the needle westerly after them. Each of the points will naturally dip downward in its own hemisphere, on account of the downward attraction of the latter; it being indeed solely owing to the balanced attractions of the two hemispheres that the points of the needle are directed toward the poles. The more powerful action of the moon in the northern hemisphere will produce a greater acceleration of the current than in the southern, which in the latter will be more influenced by the sun.

As, however, the local attraction of a piece of iron in a ship is capable of deflecting the needle, hence it is evident that similar causes at the bottom of the ocean, or in the adjoining coasts thereof, may produce similar deflections, independent of electro-magnetic currents, while the latter will be necessarily affected by the direction as well as the height of the great mountain ranges of the earth, and thereby tend to create a still greater uncertainty in the needle's variations; which uncertainty, however, from changes of current, will apply more to the extra-tropical latitudes than to the tropical, from the diminished sol-lunar influence in the former enabling other influential causes more readily to vary the direction of the above currents. The variation and dip of the needle, will be also necessarily affected by the annual changes of position of the sun and the earth with respect to each other, through which the electric and magnetic zones will be moved alternately north and south of the earth's equator, and the variation and dip be consequently made to undergo a small annual change in the respective hemispheres in unison with the above change of position of the zones.

That the needle is influenced in its pointings by the southern or magnetic hemisphere, as well as by the northern or electric, is manifested by the opposite variation and dip of the southern and northern point in the opposite hemispheres, and the nearly horizontal pointing of both in the vicinity of the equator, where the opposite attractions of the two hemispheres are balanced. Much of the uncertainty, however, relative to the pointing of needles, must be occasioned by the varying amounts of electricity and magnetism in each, as well as in the *opposite* poles of each. Thus if a needle contains a greater amount of magnetism than electricity, it will give a greater variation and dip in the northern hemisphere than when containing equal amounts of each.

Should the views, previously taken, relative to electricity and magnetism prove correct, I conceive that needles of superior power and uniformity of action may be constructed in the following manner. Take two equal bars of steel fit for needles, and insulate them on separate non-conducting plates, placing each on end, with a similar steel bar of double their length on end in contact with the end of each, the small bar intended for magnetism being the *undermost* on one plate, and that for electricity the uppermost on the other; apply the magnetic wire of a galvanic battery to the *under* end of the *first*, and the electric wire to the *upper* end of the *second*;—on being sufficiently impregnated, remove both at the same instant with non-conducting tongs, and, placing them end to end, insulate them together in a glass tube cast to fit, and seal up with wax or resin. Magnetism being undermost and electricity uppermost, in bodies upon the earth's northern hemisphere, by the above mode the magnetism and electricity from the wires would respectively expel their opponents from the small into the large bar, by which there would be magnetism alone in the one and electricity alone in the other; while the bars being equal, their quantities would necessarily be equal also, by which a more equal as well as more powerful action would be insured. In this way the electric and magnetic currents would circulate freely in the needle as now; but should a separate insulation of each be deemed best, the bars might be made to extend the whole length of the needle, having the magnetic bar the undermost in the northern hemisphere, and the electric bar the undermost in the southern.

Mass-electricity and magnetism being found, however, to occupy principally the surfaces of bodies, it would be advisable to have the needle constructed of a series of thin steel plates joined at the ends, but separated through the remainder of their length, by which a great increase of power in an equal bulk would be obtained. The great point, however, is the possibility of thus separately insulating the above bodies, a possibility which I think agreeable to reason, from their always existing separately in the opposite poles of bodies, as well as in taking separate routes in the galvanic trough. Neither do I conceive that their power would be much lessened by this insulation, seeing the manner in which compasse sare boxed round on board a ship to secure them from injury.

Should this mode of impregnating prove as effective in practice as it is consonant to reason, a moving power may thus be formed applicable to many mechanic purposes. By similarly impregnating and insulating two separate series of steel plates, having a pendulum with magnetism and electricity insulated separately on its opposite sides to vibrate between, a moving power might thus be created of almost unlimited capability; for the magnitude of the moving power being unlimited, the capability thereof, as a motorial body, would be almost unlimited also. Cotton might be thereby spun, cloth wove, and clocks made to denote the passing time, without further expense than first cost, or even labour of winding up, keeping up in fact a perpetual motion, when once set going, so long as the machinery was preserved in a serviceable state.

This species of pendulum would vibrate between the electric and magnetic bodies like the poles of the planets with the sun, alternately attracted and repelled, in the same way indeed as the pendulum of Deluc, but with a greater power and a less risk of that power being weakened, in consequence of the protection thereof by insulation. The theory of the motion of Deluc's pendulum is, that electricity is alternately given out and received in its alternate vibrations; but a reference to the attractions and repulsions of electro-magnetic bodies with each other evinces that this motion may be kept up by the above actions alone.

As the conducting power of bodies seems evidently referable to their attraction for the bodies they conduct, therefore the attractions of electricity and magnetism being the *reverse* of each other, the bodies which conduct them will, according to the above view, be of a reverse nature from each other also. Thus electricity having a strong attraction for combustible bodies, these will be good electric but bad magnetic conductors; while magnetism having a strong attraction for non-combustible bodies, these will be good magnetic but bad electric conductors. The modes indeed by which electricity and magnetism are produced through means of friction favour the foregoing view: electricity being called vitreous electricity from its ready production by friction against glass, and magnetism resinous electricity from its ready production by friction against resin, the glass being a non-combustible body, and consequently attracting the magnetism while repelling the electricity; and the resin, a combustible body, and consequently attracting the electricity while repelling the magnetism: so that electricity is made thereby to accumulate on the surface of the glass, and magnetism on the surface of the resin. If the above view be correct, therefore, a resinous insulation will be required for the magnetism, and a vitreous one for the electricity; combining the two, when insulating, electricity and magnetism together.

WINDS.

THE attractions and repulsions of the sun and moon will tend to produce a westerly moving atmospheric current, or, in other words, an easterly wind, upon the parts of the earth most under the above influences; while the easterly motion of the earth will again tend to produce an easterly moving atmospheric current, or westerly wind, upon the parts less under the said influence. This seems the most reasonable explanation of the easterly winds prevailing toward both tropics under the name of trade-winds, and the westerly winds prevailing beyond this point toward the poles. When two moveable bodies attract each other, the less must move toward the greater; and the moveable toward the immoveable, even though the latter be the smaller. The atmospheric atoms, therefore, being united with electro-magnetic atoms, and the latter being the power through which attraction and repulsion operate, the atmospheric atoms must consequently follow wherever the attractions or repulsions of their other constituents direct.

At the poles the hot wind drawn from the tropics has its atomo-electricity expended, in summer, in assisting the sun-beams in thawing the ice and snow; and in winter again in counteracting the congelation of the water, when the sun's beams no longer reaching these parts admit a rapid freezing to go on. The cold or magnetic air thus created by the abstraction of its electricity is now attracted toward the equator by two electric forces, viz. that of the northern mass-electric belt, and that of the atomo-electricity poured down more powerfully by the sun upon the regions there. These polar winds first approach the equator seemingly from an almost due east direction, a deception partly arising from the easterly motion of the earth; but closer to the equator, this seeming direction is from nearly due north and south. This easterly tendency is doubtless owing to the moon's rapid easterly rotation of the earth at the equator, in conjunction with the greater attraction of the electro-magnetic belt there.

The sun showering down his hot perpendicular beams upon these cold polar currents, they become in consequence rapidly heated, by which their particles are made to repel each other more powerfully, and thus rise into the upper regions, to be attracted toward the poles by the cold magnetic bodies there, having their place quickly supplied at the equator by fresh polar atmospheric currents, destined to pursue a similar course. The greater attraction of the great northern *electric* belt for magnetic air than the great southern magnetic belt, is the only reason I can divine for the southerly trade-wind blowing across the equator into the northern hemisphere for the greater part of the year, while the northerly trade-wind seldom reaches the equator.

Thus the equatorial regions are the great focus of attraction for winds, as well as all other moveable bodies, being the grand centre which the whole atmosphere of the earth must in due course visit to carry off its load of heat, to be deposited as it proceeds in its journey wherever there is a demand. The cold currents from the poles to the equator, and the hot currents from the equator to the poles, in this way temper the extremes of climate as they move onward: the former moderating excess of heat, and the latter excess of cold; the former skimming along the earth's surface toward the equator to cool down the hot regions in that direction, and the latter soaring at once into the heavens to avoid coming in contact with places already too hot. By these beautiful and harmonious motions of the wind, extensive countries are thus rendered habitable; which, but for this wise provision of Providence would be verging always upon a state of either semicongelation or semi-combustion.

The great electro-magnetic belt of the equator may thus be compared to a huge reservoir, into which the whole atmospheric ocean surrounding the earth must be successively poured and outpoured. The attraction and capacity too of this basin being always nearly the same, with no obstacle to the inflowing or the outflowing of the atmospheric current, a more general equilibrium of the quantity of atmospheric matter within its bounds will be the consequence: like in a water basin whose inlets and outlets are of the same capacity, the water always standing nearly at the same level in it. This seems the most probable cause of the barometer always standing at nearly the same level within the tropics,—while outside of, them, where the above causes of atmospheric equilibrium do not exist, it is subject to so many fluctuations.

The rising of the mercury in the barometer with an easterly wind seems referable to its being pressed upon between two opposite forces (viz. of the earth moving eastward, and the atmosphere westward), in *addition* to the force or weight of the downward attraction of the atmosphere by the earth; —and its falling during a westerly wind to the latter force *alone* operating, from the earth and the atmosphere then moving in unison together.

RAIN.

ELECTRO-magnetic attractions and repulsions must influence the motions of the atmospheric vapours as well as those of the winds; seeing that these influence every thing throughout space, from the mightiest mass to the minutest atom, from the positions and the motions of the universe of worlds to the glittering sun-mote or the imperceptible particles of the falling dew.

For rain to descend in any country it is not only necessary that moisture-bearing winds should blow over it, but that it should be in a *reverse* electric or magnetic state to that of the vapours. If the earth be in a hot electric state, and the vapours equally so, they will repel each other, and no rain consequently fall; and the same reasoning will apply when they are in an equally cold magnetic state. It is only therefore when electricity or magnetism is in excess in either the vapours or the earth, that these vapours can be attracted to the latter in rain drops.

Moisture brought by the warm electric winds is the common source of rain in the colder northern and southern latitudes, from the cold magnetic land there, attracting downward the hot electric moisture; while in the warmer latitudes, toward the tropics, the cold polar winds are the cause of rain, by their cooling down the hot vapours there, and thus enabling them to be similarly attracted by the earth. When winds move rapidly, this attraction is materially counteracted from their bearing the vapours along with them, and therefore slow-moving winds are, generally speaking, the best rain-bearers.

Wherever the earth contains a mass of non-electric conductors in its composition, or when it is brought into a bad conducting state by drought, rain seldom falls; and when it does, it seems to fall with reluctance. Throughout Lower Peru, where the whole soil is a mass of imperfect conductors, there is seldom more than a wintry drizzle; while, after the earth has been dried up by long droughts in our own country, how often may be seen rain-clouds upon rain-clouds hovering over it, as if eager to shower down their watery wealth, eventually compelled to sail away to more inviting regions; and this tantalising spectacle continued day after day until some electro-magnetic tempest broke the spell, and hurled down the moisture in as great abundance as it had before been scantily withheld.

Bodies are bad electric conductors in consequence of their inferior electric affinity, and hence cannot attract the vapours when the latter are in an electric state.

INFLUENCE OF THE SUN AND MOON ON WINDS AND RAIN.

I HAVE already alluded to the influence of the sun and moon tending to cause an easterly wind in the more tropical-lying regions, over which their attractions and repulsions are chiefly exerted; and of the easterly motion of the earth tending to cause a westerly wind in the more polar-lying regions beyond, less under the influence of the sun and moon. Every change, however, in the state of the above luminaries with respect to the earth, will tend to produce a change of wind as well as of weather in some part of the latter.

The attraction of the sun with the earth is greatest in June, and his repulsion greatest in December, while both of these are least when he is moving in the neutral line with the earth about the months of March and September, the vernal and autumnal equinoxes.

That the moon exerts a powerful influence on the winds and the weather has been a prevalent opinion in all ages, though many have been shaken in the belief of this power from observing that the changes of wind and weather as often took place during other periods of the moon, as at full and change, or in the quarters; the periods supposed to have most influence on the weather. The principal if not the only influence which the moon can in this way exert must be through her attractions and repulsions with the earth, and the diminution of these when moving in the neutral line with the latter: so that as her periods of greatest attraction and greatest repulsion, and of moving in the neutral line, only correspond at distant periods with the phases above alluded to, hence the disappointment so generally met with by those anticipating changes of weather from changes in the phases of the moon. Instead of full, change, and quartering, therefore, we must look to the periods of her greatest attraction and repulsion, and of moving in the neutral line, for the effecting of the above changes, the most likely period for such to happen being when her attractions and repulsions upon the earth are least, viz. at the time of her neutral line period with the latter, from the earth being now enabled to exert her own attractions more strongly upon the atmospheric particles and vapours on her surface, and to move them to and fro as she lists. It is at this period, therefore, that rain is most likely to fall: a likelihood necessarily much increased should the sun be in the neutral line with the earth at the same time. Thus the moon, besides the agreeable light with which she enlightens the earth, exerts also a constant influence over the winds and the vapours on the latter's surface, conferring thereby a more pleasing variety of climate by the changes to which she gives rise; while, being propelled by the sun alternately from one hemisphere to the other, as summer approaches in that in which she reigns, she is thus enabled more effectually to controul the violence of the wintry elements that might otherwise be productive of the most disastrous results to both agriculture and navigation.

The attractions and repulsions of the sun being however more powerful, as well as more extensive, than those of the moon, and the period of his moving in the neutral line being much longer also, consequently his attraction and repulsion will exert a greater influence upon the winds and weather than those of the moon; while his longer movement in the neutral line with the earth will give the latter more time to exert her attractions, as well as more power of carrying them into effect, from the influence of the sun being now paralysed. Hence the hurricane season in the northern tropics commences as the sun begins to decrease his repulsion with the earth; and that in the southern tropics, as he begins to decrease his attraction, when slackening as it were his bridle rein upon her; and hence also the violent gales and rains which the equinoxes produce when he has thrown the reins upon her neck, and allowed her thus to wanton with the winds and waters at will.

The sun vibrating with the southern hemisphere of the earth will naturally exert a more powerful influence over the winds and the vapours there than in the northern hemisphere, while the moon (as I am led to believe) vibrating principally with the latter, will exert a greater influence in the northern hemisphere than in the southern. This will apply, however, chiefly to their attractions and repulsions; because when moving in the neutral line both hemispheres must be nearly similarly influenced.

PERIODICAL CHANGES.

The weather is subject to periodical changes, extending over a series of years, too regular in their extent of duration and their returns to be the work of chance; a series of dry years of weather being usually succeeded by a series of years of rainy weather, and these again by a series of years of moderate seasons, if such have not already intervened between: each series generally extending over a period of from two to three years.

These periodical changes, though much more marked in the tropics and latitudes bordering thereon where the sol-lunar influence is greatest, are still sufficiently apparent in the more polar regions. Their continuance for a series of years implies their causes to proceed from bodies continually operating upon the earth, and these bodies are in all likelihood the sun and moon. The influence of the moon in fact must be generally prejudicial to the descent of rain upon the earth, from her counteracting more or less the attractions of the latter upon the vapours. This influence of the moon upon the vapours is so well known indeed to old seamen, as to have generated an expression among them during hazy weather, of "Wait till the moon rises, and she will soon eat up the fog;" a result I have often witnessed from the moon's rising.

Her influences, therefore, upon the seasons, as it is found to be upon the tides, will necessarily be greater in proportion as the tropic circle in which she moves is approached, and consequently greatest of all within the latter; so that as we progress from the tropics, the seasons must be more uniformly moist, and *vice versâ* as we approach them more uniformly dry: giving thus to the tropical latitudes a climate of great extremes, corresponding to the great extremes of the sun and moon's influences there. When we contemplate, however, the diverse capabilities of the sun and moon in raising or depressing the ocean-tides according to their relative positions with each other, we may consequently admit similar diverse capabilities of their relative positions in influencing the nature of the seasons as to dryness or moisture. The periods, however, of dry, of rainy, and of moderate seasons, continuing over a series of years, we must not therefore look for the causes of the above in the ordinary rapid changes in the relative position of the sun, moon, and earth taking place daily, monthly, and yearly, and prominently conspicuous to all; but in those slower changes, remarked only by the astronomical eye, extending over a series of years, viz. the slow westerly movement of the lunar points of greatest attraction and repulsion with the earth, by which they complete a westerly revolution from the sun to the sun again in a period of rather more than nine years. Now, as the above lunar points are each in conjunction or opposition alternately with the sun once during the said nine years, and the lunar neutral line or equinoctial points twice in conjunction and opposition with him in the same period also, four great epochs thus take place in each nine years' revolution, at a distance of two years and four months from each other, in which great changes in the seasons are likely to be brought about.

As the attractive and repulsive influences of the sun and moon, through the medium of their electro-magnectic zones, must necessarily be of a similar nature; therefore, the only difference between them will naturally be in the greater body possessing more of this influence than the lesser: and hence the influences of the moon's positions upon the earth in affecting the weather will be best illustrated by a reference to those of the sun. Thus, gales of wind and heavy rains being the usual result of the sun's movement in the neutral line at the equinoxes, in the extra-tropical regions, we may consequently infer that when the moon's bi-monthly equinoxes take place, at the period of her being in alternate conjunction and opposition with the sun, heavier gales and rains may be anticipated in the above extra-tropical regions. The amount of rain, however, will necessarily depend upon the winds thus produced blowing from the sea or from the land; so that the vernal equinox winds in the northern hemisphere being usually easterly, and the autumnal equinox winds westerly, this reversion of winds consequently tends to cause drier springs and wetter autumns in northern Europe than in northern America, and wetter springs and drier autumns in the latter than the former, from the west being the rain wind in the one, and the east the rain wind in the other. In the southern hemisphere, however, the equinoctial winds blow from the east at the northern autumnal equinox, and from the west at the vernal, though still corresponding in their designation to those of the north, from the spring and autumn months of the latter, being the autumn and spring months of the former. The hurricane and rain months again, in the northern tropics, taking place while the sun is relaxing his attraction upon the earth, and those in the southern hemisphere when he is relaxing his repulsion; we may therefore infer also, that should the moon be relaxing at the same time her attraction on the one hand or her repulsion on the other, when either in opposition or conjunction with the sun, heavier rains and winds than usual will take place in the above respective latitudes. Should the above views be correct, there would be a tendency to very rainy seasons every four and a half years, in the extra-tropical latitudes, conferring two of such cycles of seasons upon them during the nine years' revolution of the moon. If the rainy seasons be ascribable to the lunar equinoctial points being alternately in conjunction and opposition with the sun, the dry seasons must be owing to the lunar points of extreme attraction and repulsion being alternately in opposition and conjunction with him also, or else one of these points only; producing thereby dry seasons at four years and a half, or nine years of interval from each other. But as both the above series of lunar points would be sufficiently near the sun to be influential for a longer period than a year, therefore the wet or the dry seasons might be continued over a two-years' period, or even longer, particularly should other assisting causes contribute thereto. The changes in the earth's axis, called her nutations, as well as her changes of polar parallelism, may tend to do this: their extent of period evidently showing their cause to be in the westerly revolution of the lunar points. Thus the latter is performed in a period of nine years, and the revolution in the moon's nodes, and in the earth's nutation, as well as the latter's changes of polar parallelism (if I can comprehend astronomical description aright), are completed in a period of about nineteen years; the periods of the three last therefore being rather more than double the period of the first, showing thereby a connexion between the whole. The coincidence, again, of the above with wet and dry seasons is very pointed; a series of dry seasons taking place about every ninth year in New South Wales, extending over a period of from two to three years, like those which have done so much mischief of late in the Cape Verds, Chili, and La Plata. In England, again, cycles of seasons have been noticed by observing men, corresponding closely to the above; the disastrous wet harvest of 1799 and 1816 pointing to a cycle of about eighteen years, nearly approximating to the eighteen years' revolutionary period of the nutations *. By a comparison of the position of the lunar points during the various years distinguished as very wet or very dry, a conclusion may be readily arrived at, whether the above lunar revolution influences the seasons or not, from the lunar points coinciding or not coinciding in the respective wet or dry years; while if they do coincide, the particular position of the lunar points causing these seasons will be thereby ascertained.

The approach of the earth nearer to, or her recession farther from the sun than usual, will naturally also cause a great change in the seasons. If, for instance, the earth should come in a direct line between any of the superior planets and the sun, while she is *moving toward* the latter, their repulsion will accelerate her onward motion, and thereby force her to a nearer approximation than usual with the sun; in consequence of which she will be more powerfully repelled, and thus made to recede as proportionably far from the sun as she had been previously made to approach him. This will cause the southern summer to be hotter and southern winter colder than usual, on account of the nearer approximation of the earth's southern hemisphere to the sun in the former period, and its greater recession from him in the latter; while the same causes will render the northern summers colder and the northern winters hotter than usual, provided there be no increased angular motion of the earth, a circumstance not unlikely to happen. The accelerated motion of the earth above spoken of will necessarily render the atmospheric vapours less liable to be attracted by her, thus giving a tendency to drier years in both her hemispheres. When coming, however, in a direct line between any of the superior planets and the sun, while *receding* from the latter, her motion will be retarded instead of accelerated, as in the preceding case, and the reverse effects of the foregoing illustration consequently produced, neither approximating so near to, nor receding so far from, the sun as even in ordinary years: thus giving a tendency to moist temperate seasons throughout both hemispheres of the earth. But when the earth's motion has been either preternaturally accelerated or retarded, it will necessarily be some time before an adjustment thereof takes place, and hence the above seasons may be of some continuance, if not counteracted in the interim by the action of another passing planet. The inferior planets, Venus and Mercury, will of course have a contrary action to the superior planets; the above actions of them being necessarily greatest when they are nearest to the sun, and those of the inferior when they are farthest from him.

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* The present wet winter fully bears out the truth of the above cycle, while the nine years' cycle is similarly strengthened by severe westerly gales and high tides, resembling those of 1824, occurring during the present wet winter also.

Variations of seasons, particularly as relates to heat and cold, are doubtless, however, frequently occasioned by an increase or diminution of the usual amount of heat radiated from the sun. The sun's aspect at rising or setting is indeed frequently indicative of the temperature of the succeeding day; for when unusually pale, a cold or at least a cool day may be expected, and when of a fierce fiery heat, a hot day as well as a hot wind also, in countries subject thereto; the pale aspect evincing an unusual amount of electricity, while the greater redness at rising and setting may be ascribed to the lesser atmospheric refrangibility of the red rays, admitting them thereby to be radiated to a greater distance over the earth before being bent down thereon to meet the human eye. The above subject is a most interesting one to the whole human race: as, by once attaining a knowledge of the *causes* producing the great changes in the seasons, wet, dry, and favourable years might be predicted with a considerable approximation to truth; by which the husbandman would be better able to suit his sowing to the seasons, and thus secure a sufficiency from the good years to supply the deficiency of the bad, while guarding against eventual loss in planting of seed in places where either the excessive rain or the excessive drought might occasion the destruction of its product. Hence the great benefit that would result from meteorological observations on the winds and rain, kept on various points of the globe; by which, from the comparisons together, and with the respective positions of the heavenly bodies at the time, a meteorological table of infinite value might eventually be appended to the almanac.

The atmosphere, the atmospheric vapours, and the weight of bodies, must also be considerably influenced in the hemispheric neutral line, by the opposite attractions and repulsions of the hemispheric zones, between which they are placed, from the magnetic poles of the above bodies being attracted laterally by one hemisphere, and their electric poles laterally by the other, through which the poles of all bodies in this space would be changed from a vertical to a horizontal position with each other, and their movements consequently influenced thereby. This changing of poles by lateral hemispheric attraction is doubtless one of the causes of the almost incessant rains between the trade-winds, both the hemispheric zones here uniting to attract downward the atmospheric vapours, from their joint attractions operating on both poles of the above particles; instead of one pole of these being attracted and the other repelled when acted on by one hemisphere only.

LIGHT.

THE strong resemblance in properties between the rays of heat and light emanating from the sun, have led to a belief of some identity existing between their constituent principles. Both coincide in their ready transmission through transparent bodies, in their radiating in straight lines, and in being reflected and refracted by the same bodies at the same angles; while wherever light enters heat enters also, so that to exclude the one you must exclude the other. The rays at the extreme edges of the rainbow fan, into which the sun-beam is refracted by the glass prism, are the red rays on the one hand and the violet rays on the other: the first of which I have previously demonstrated to consist principally of atomo-electricity, from their power of exciting heat, and of producing all the effects of electricity or heat on bodies; while the latter I have similarly demonstrated as being constituted principally of atomo-magnetism, from their exciting a magnetic power in bodies, as well as from their great affinity for oxygen, and being colder than the red rays.

As, however, all the sun's rays (even including the red and the violet) are more or less capable of exciting the sensation called heat, as well as of extracting oxygen from bodies, it may be reasonably inferred, therefore, that they are all composed of varied atomic proportions of these two bodies: magnetism prevailing toward the violet ray, and electricity toward the red.

From the above, therefore, we may view the sun as a huge galvanic battery, pouring incessantly down his electro-magnetic rays upon the earth, for the vivification of every living substance thereon, as well as for the assisting in the completion of those great changes which it has been undergoing since its formation, with the wise view of making it a fitter nursery for the animal and vegetable creation which the beneficent Author of all has implanted upon it.

REFLECTION AND REFRACTION.

It may be inferred that the particles of nitrogen and oxygen constituting the atmosphere have, like other bodies, electricity or magnetism occupying their upper or their lower poles, according to the hemisphere in which they are situated. Thus in the northern or electric hemisphere, magnetism will occupy their lower poles and electricity their upper, while in the southern or magnetic hemisphere the reverse will be the case: an atomic polarity which the attractions and repulsions of the above hemispheres must necessarily tend to sustain through every varying atmospheric change. Supposing the atmosphere to be at rest, the particles thereof would, by the position of their attractive and repulsive poles, become united to each other in a longitudinal line, extending like radii from the earth toward the heavens, with the magnetic pole of one particle in attraction with the electric pole of the other; and by the circumference of the circle described by them toward the heavens being the *largest*, the atmosphere would thus be progressively diminished in density as this *outer* circle was approached. The progressive diminution of atmospheric density as we recede from the earth, as well as the phenomena of atmospheric refraction, favour this view of atmospheric arrangement, the rays of light and heat radiated at an angle from the sun to the earth being bent *inwards* toward the perpendicular, while those radiated from the earth toward the heavens are bent *outwards* from the perpendicular, a course that naturally would be given them on coming in contact with any of these atmospheric lines, to be deflected thereby and pass between two of them *to* or *from* the earth. There is nothing in this view militating against the passage of these rays in a transverse direction between the atmospheric lines, or even between the particles composing them, which they evidently do: the above view only applying to those radiating particles of heat and light striking against the atmospheric particles instead of passing between, and being thereby deflected along the lines which they form.

The only visible difference between reflection and refraction is, that the former is applied to the effect produced upon the rays of light and heat by the particles of bodies which they *cannot* pass between, and the latter to the same effect produced by the particles of bodies which they *can* pass between; the angles of both reflection and refraction being the same, and the cause of both the same also, viz. the coming in contact with a substance they cannot penetrate, and which consequently alters their course. The usual zig-zag course of lightning in the atmosphere, when attracted by bodies, while showing its affinity to light and heat by its angular refractions, illustrates also in a visible way the refractions of the above bodies, when meeting with other bodies sufficiently powerful to obstruct their course toward the body which attracts them.

The lesser refrangibility of the sun's electric rays than of his magnetic may be owing to the greater *velocity* of the former, caused by the greater repulsion from the sun, or their greater attraction by the bodies toward which they were moving; by which greater velocity they would *more* readily force their way through the atmospheric lines, and be thus *less* readily refracted. This greater velocity from solar repulsion may be easily supposed to exist from the sun evidently containing more electric than magnetic matter, as evinced by his rays uniformly exciting the sensation of heat; while the velocity from attraction by other bodies may be accounted for by all bodies within his sphere containing *less* electric matter than him, and therefore having a greater attraction for this than for his magnetic matter.

MUSIC AND SOUND.

NOTES of music seem but mere undulations of sound, so modulated as by the harmonious variety of their changes to keep the animal body in a constant state of pleasing agitation, — now kindling up into a wild delirium of joy, now melted into tears, and now plunged into the abyss of melancholy, according as the exciting or depressing tones predominate. That these feelings are produced by the electro-magnetism in the atmospheric undulations seems consonant to reason, from the similar sudden excitements and depressions which electric sparks produce in the animal body; though by their suddenness, greater intenseness, and want of variety, are necessarily of a disagreeable rather than of a pleasing nature.

In excursions indeed to the top of mount Etna, sounds have been heard sometimes meltingly musical, and sometimes hoarse and discordant, doubtless caused by the electro-magnetic currents issuing through the volcanic crevices of the mountain.

People of nervous temperaments, and consequently most excited by electric impressions, are also most excited by music; while those most subject to an overflow of spirits, are also most subject to the greatest depressions thereof; as an inanimate substance which receives atomo-electricity quickly, in haste parts with it. Sound varies in its influence upon the feelings, according to the varying magnitude of the atmospheric oscillations, and therefore according to that of the bodies causing these: the musical notes of small strings or small flutes, being as lively and exciting as those from large are mournful and depressing, while the sound of small streams and the notes of small birds afford a similar contrast with those that are large.

The larger indeed the animal, the more discordant in general the voice, with the exception of that of man, which by a system of judicious training he has been enabled to modulate to every musical cadence.

By analogy with the motion of fluid and gaseous bodies (such as exhibited by the moving water from a pipe, or the moving smoke from a gun-barrel,) I would infer that sounds are produced by rotatory oscillations in the air; these oscillations being in all likelihood spiral from wind instruments and axillary from stringed, at least such would be the species of atmospheric motion most likely to be excited by the above different oscillations.

The denser the air, the more powerfully are these oscillations excited; and the stiller it is, the greater the distance to which they are so excited throughout it. In the dense moist atmosphere preceding rain, and in that toward the poles, sounds of all kinds are powerfully conducted; while along the beds of woody banked streams, they are sometimes heard echoing throughout their various windings, for miles, in calm evenings, with all the pleasing modulations of a flute.

Similar feelings to the above are experienced by the viewing of large or small objects: the contemplation of vast prospects, however harmonious the groupings, exciting at first glance a sensation of awe, while that of similarly constituted small ones excite sensations of a pleasing exhilarating nature, varying as the prospect varies over which the eye roams.

REVOLUTIONS IN THE EARTH.

THE changes effected in the structure of the earth since its first formation may I conceive be all accounted for by causes operating within itself, without reference to extraordinary external agency. It seems indirectly borne out, by phenomena yearly demonstrated, that the external crust of the earth only is solid, and that the internal part is filled with fluid or gaseous bodies; for how otherwise could even modern earthquakes so easily effect such wonderful changes in its surface, heaving up its solid parts at one place from the bottom of the ocean into goodly islands, and at another depressing the dry land beneath the surface thereof? or sinking it down in interior regions, until deep and extensive lakes occupied its fomer site, while causing the whole superfices influenced by the shocks to quiver and undulate like the waves of the sea.

Such proofs are still frequently witnessed in both hemispheres; but the western coast of South America exhibits on the grandest scale what has been effected in this way during no very distant periods. From Conception (Chili) in 37 South latitude, to Tumber (Peru) in 3 South latitude, a distance of 2000 miles, the coast, for an average of 70 miles interiorly, bears incontestible marks of an elevation comparatively recent, many of these elevations contiguous to the sea having even been effected since the Spanish conquest. The clay soil has the appearance of that burnt in England for manure, and in some of the dry narrow ravines emits an odour like new-burnt bricks, while beds of shells are found at intervals of the identical varieties at present existing in the neighbouring ocean, in too vast quantities and at too great a height to admit their deposition there by any other cause except sudden elevation along with the bed of the sea. Where they are imbedded in clay or sand they are semi-calcined, frequently crumbling between the fingers like slaked lime; while, when imbedded in the stony strata, they are more or less vitrified and united firmly with the rock; the solid nature of the latter enabling it to conduct the subterraneous heat more powerfully than the sand or clay, and thereby vitrify the shells with which it was intermingled.

The geological strata in the different hemispheres which I have partially examined, have all indicated by compass a medium N.N.E. and S.S.W. bearing; and in this line nearly I find all the earthquakes of both North and South America to have passed whose routes I have been enabled to trace; the two latest in Peru coming from the South, showing their causes to have been generated near the South Pole. Deeming their causes to be electro-magnetism, I conceive the latter to have been produced at the South Pole, as before exemplified, by the condensation of the fluid waters into solid ice; by which condensation the atomo-gaseous-electro-magnetism, if I may so term it, was converted also into fluid electro-magnetism.

That electro-magnetism is the cause of earthquakes, seems evident from the rapidity of their motion; from the countries in which they are common being composed of bad conducting materials, by which greater violence is produced in their passage; by their being most liable to occur after rain, when the conducting properties of the soil are somewhat improved; and by their resolving of the silver ores into pure metal, known by what is called, "the growing of a mine."

The greater mass, and consequently greater attraction, of the electro-magnetic girdle at the equator, will necessarily tend to draw the under electro-magnetism currents evolved at the poles toward the equatorial neutral line, assisted in this by the earth's rotation directing them upwards towards the earth's centre, while checked in their attempts to force a passage through the latter's superficies by the pressure of the electro-magnetic zone and atmosphere surrounding it.

These currents, when not in sufficient intensity therefore to burst out in shape of new volcanoes, would gain vent partly through the craters of old ones, but chiefly through the equatorial neutral line, out of which they would be whirled in successive streams by the earth's centrifugal force, if not previously forced to commingle with the electro-magnetic hemisphere to supply any loss of volume it might have sustained.

In the calm equatorial latitudes between the trade-winds, where the hemispheric neutral line must necessarily exist, electro-magnetic flashes and electric squalls and showers are almost incessant; corroborating in some respects the idea of the electro-magnetic under-currents obtaining a passage here; while the idea of the pressure of the electro-magnetic zone and atmosphere enveloping the earth, preventing the egress of these currents from the latter's superficies, seems also borne out by the fact of volcanoes almost uniformly bursting forth from the highest and most peaked mountains, where the resistance opposed by the above bodies must consequently be the least.

The idea of the earth's rotation throwing out the electro-magnetism by centrifugal force, is also similarly exemplified in the sparks elicited by the whirling of electro-magnetised bodies in the class room; an experiment demonstrating the *true* cause of the severe bodily injuries so often inflicted by what is called "wind of shot."

The motions of the electro-magnetic under-currents from the pole to the equator, heaving and cracking (even at the present day when sufficiently powerful) the earth in a northerly and southerly direction, give an idea how the geological strata were first formed. At early periods, when by evident proofs the earth was in a state of fusion, the first solidification would naturally take place around the poles, on account of the cooling process going on most rapidly there. This solidification would naturally operate in the same way as we see the solidification of water operate at the present day, by converting a portion of the atomo-electro-magnetism into mass, to be radiated upwards in the shape of aurora borealis, or directed in an under-current towards the equator.

As the cooling process proceeded, and the earth thus progressed toward a state of solidification, the action of the above under-currents, the earth's rotation, and the influence of the sun and moon, would all tend to give, by their joint efforts, a north and south bearing to the first strata in a semi-fluid state, which solidifying by exposure would serve as a nucleus for the other strata to incline against. The future electro-magnetic currents would be naturally attracted toward this more solid matter in their course, from containing more matter in less bulk than the fluid matter; as winds are attracted by contiguous shores, following often all the windings of their course: so, in the same way, each successive electro-magnetic current would follow all the windings of the coast of the first solid stratum, making successive additions thereto.

A westerly tendency would naturally be given to the various strata by the action of the sun and moon, by which those emerging on the eastern side of an older stratum would be inclined by a gentle slope against it; while those emerging on the western side, would be either thrown up almost perpendicular or projected into the sea, to be carried off in its current. The gentle sloping of eastern strata and of eastern shores, compared with the abrupt precipitousness of both strata and shores on the western coasts of countries, tend to strengthen the above view, which acquires a farther confirmation by the generally greater amount of land on the eastern than the western sides of the great dividing ranges of countries, more particularly South America, Britain, and Ireland, that have only *one* great dividing range.

As the cooling of the earth proceeded, its matter, thus becoming less and less fluid, would consequently be less and less capable of being projected to the height of the first strata: thus producing a diminution in altitude of the various strata which succeeded, and consequently of the mountains which they might form. How the various strata should differ so materially from each other in their appearance, as well as in their chemical constituents, seems referable to the quicker or slower solidification of their matter. Granite, the oldest rock, is constituted of flint (the oxide of the metal silicium), found by Sir Humphry Davy to be the most difficult to deprive of its oxygen of all the metallic earths, and consequently the one having the greatest affinity for it. There being evident proofs at the present day of the reduction of the metallic earths to pure metal in the earlier periods of the globe, consequently the metallic silicium having the strongest affinity for oxygen, would, on the cooling of the matter of the globe, be among the first to become solidified by oxygenous absorption, thereby causing it to be the principal constituent of the *first* formed strata.

The petrifaction of shells, wood, and animal fibre in many of the later strata of the globe, shows clearly that the earths have been, partially at least, reduced to the metallic state during even late periods of the world's history. The shells being upon the surface would be less liable to reduction than the deeper-seated earths, like the silex; so that the latter in flowing outwards, by reason of its known great lightness, would in its hot fluid state come in contact with the oxide of calcium composing the shell, and by its greater affinity for oxygen seize that of the calcium, and becoming thus solidified assume the form of the shell, while the calcium flowed off in a liquid metallic state. Wood and animal matter also containing oxygen in their composition, this would be similarly attracted by the hot fluid silicium, and their other gaseous products dissipated thereby.

The above is indeed a process analogous to that exhibited at the present day in some of the copper-mines; where, by placing a bar of iron in the mine water, containing a solution of sulphate of copper, the iron gradually disappears, and a copper bar of similar form occupies its place,—there being only this difference between the two operations, that the *solid* here attracts the oxygen from the *fluid*. Gold also, a metal having a less affinity for oxygen than any of the others, is found principally among the earliest granite strata, and that in a pure metallic state; its weak affinity for oxygen admitting the latter to be easily abstracted from it: thus explaining why it abounds so in the primitive strata; because these solidifying first, on account of their greater affinity for oxygen, would naturally abstract this oxygen from bodies like the oxide of gold, that most easily parted with it.

The effects of the earth's centrifugal force (by reason of its axillary rotation) upon the elevation of the earth's strata, and of the greater intensity of electro-magnetic action in the early eras than now, are exemplified in the highest mountains being situated near the equator, where the earth's rotation, and consequently centrifugal force, is the greatest, and in the earliest strata having the greatest amount of active or extinct volcanoes in them, as well as exhibiting proofs of a greater state of liquefaction by the regularly-crystallised forms which they present.

The progressive extinction of volcanoes over the earth's surface, as well as the progressive imperfection of crystalline arrangement in the strata, according as we descend from older to later eras, pourtray the above progressive diminution of electro-magnetic energy in the earth; the late strata exhibiting in their constitution fragments of nearly all the earlier strata, agglutinated imperfectly together, in the same state of medley arrangement that we find in volcanic tufæ in the late strata of Peru; nodules of granite, quartz, iron-stone, and slate being all mingled in one chaotic mass together.

Are we to ascribe the lesser electro-magnetic intensity of late eras to a diminution of mass-electro-magnetism in the earth; or to such a change in the solid crust thereof, as to make it a better conductor, and thereby enable the former to be more equalised as well as more easily transmitted throughout it? I conceive the latter to be most probable; otherwise, the earth must have in earlier periods been farther from the sun than now, while the progressive addition to the solid parts thereof, since the solidification of the first strata, as well as the progressive amelioration of its soil, for the purposes of vegetable life, imply an easier transmission, and consequently a more general equilibrium of the mass-electro-magnetism throughout it.

We have a singular instance of the improvement of soils, by the sun's atomo-electro-magnetic rays, on turning the former up, and exposing them freely to the latter's salutary influence; and by inference, therefore, may we not conclude that the electro-magnetic currents beneath the earth's surface have long been exerting a similar salutary influence in ameliorating the soils there?

If such be the case, the now-sterile unirrigated soil of Lower Peru may eventually become as fertile as it is now sterile, by the electro-magnetic currents gradually making it a better and better electro-magnetic conductor, and consequently a better rain attractor, by which it may be hereafter enabled to furnish food for the maintenance of a population as dense as that of older formed countries.

At the period of a semi-fluid stratum being suddenly raised from under the waters, the water elevated therewith would naturally in its backward descent excavate hollow courses therein, to be afterwards still further enlarged by the continued action of the rains and winds: the *first* washing and the *second* blowing the loose particles of earth away, when in the latter case dried into dust. In Lower Peru, where rain rarely falls, the wind has been the main modifier of hills and vallies since their projection from the deep; and, judging by appearances, its potency in this way seems no way inferior to that of rain, the hills having as sharp ridges, and as sloping outlines, and the valleys being as deep as the generality of those in rainy countries. No one who has travelled in Lower Peru, in windy weather, can indeed for a moment doubt the capability of the wind in effecting the above changes, when contemplating the blinding clouds of dust and sand that everywhere encounter him, hurled along the plains in showers, and whirled in eddies from the hills into the adjoining ravines, to be eventually blown out at the ends thereof, by the strong gusts rushing at intervals through them.

The land around Bahia, (Brazil,) presents a fine illustration of the mode by which rain torrents lengthen and widen valleys, and thereby shape out the form of the adjacent hills, the country (a table land of red clay) being moulded thereby into narrow tortuous ridges, with equally narrow and tortuous as well as deep valleys between, all communicating by gradually widening mouths with the sea. At the head of each valley the torrents in the rainy season open a myriad of small water-courses down the face of the declivity, which by successive enlargements gradually merge into each other, and thus continue onward the valley,—fresh courses being always formed as the old disappear, while as the main valleys progress into the country, smaller ones branching out from them to the right and left, excavated by a similar process, drain the land out of their reach. None of these main valleys ever communicate with each other, though often approximating very close, ramifying through the interior of the country like an artery through the animal body, for equally beneficial purposes.

The influence of streams upon the modification of land in their vicinity, can, in a literal sense, be only applied to the actual extent of the beds in which their waters run. Where their fall is considerable and their beds constituted of earthy matter or easily decomposed rocks, they will naturally *deepen* these beds; but where there is little fall, and their stream is consequently sluggish, they will be more disposed to *elevate* them, by the deposition therein of the alluvial washings from the higher grounds above, while the beds of those composed of difficultly decomposable rocks, are so speedily covered with slimy mosses, as to counteract in a great measure the action of the most rapid torrents upon them.

The remains of tropical vegetation found in many of the European strata, show that the earth either approximated nearer to the sun or contained more internal heat formerly, than now, or that its poles have been changed since the existence of the above plants. The first could only have been the case in consequence of the earth containing less mass-electro-magnetism *then*, than *now*,—the second we can readily suppose from the marks of intense ignition which it exhibits; and as the cooling process would be naturally slow, the above tropical plants might have been produced, when it contained a sufficiency of internal hot-bed heat to force them forward, while the *third* could only have been brought about by some comet suddenly approximating it.

If the general bearing of all the strata throughout the world is found to be much to the eastward or westward of north, a change of pole may be surmised; but should antediluvian tropical productions be found in the respective antipodœan strata corresponding to this change, and more polar productions in those of the tropical latitudes, we may infer such a change to have occurred. Thus we find numerous remains of similar tropical plants (such as gigantic reeds and palms) in the London clay, and coal fields of England, and in the coal fields of her nearly southern antipodes New South Wales; but a more extensive comparison of the vegetable remains of the various latitudes of the earth must take place, before any just conclusion can be drawn. Should a change of pole be proved by the above means, this change was most likely effected by the moon in first approximating the earth as a planet.

On contemplating the various geological strata of our globe, we find that it has been subjected, since its first formation, to numerous overwhelming deluges and volcanic derangements, all increasing the extent of the habitable part thereof, destroying at the same time, and burying the whole of the living creatures occupying the sea and the land at each successive disaster, that a new and more perfect race might supply their place.

We see in each successive series of new animals the progressive aim of the Deity toward perfection, advancing from the almost inanimate shell-fish of the early eras, to the more noble mammalia of the later, and thence to the last and greatest era, in which the noblest of all—man, was created. Seeing thus that our earth has undergone so many great changes, are we to conclude that the workings of the Almighty mind towards perfection, as regard us, are finite? as the sacred writings warrant us in believing, or that we are to experience a similar annihilation, and a nobler race of beings created in our place,—burying as it were in a second Herculaneum all the magnificent structures in literature, science and art, of which we now so proudly boast, leaving the succeeding new creation to work up hill, and in the dark, as we have done, until a similar magnificent fabric has been created, only to be subjected to the same inevitable catastrophe?

CONCLUDING REMARKS.

THE science of electro-magnetism is still in its infancy, and there is no calculating when further advanced to what useful and important purposes it may be yet applied. Electricity embodying the substance called heat, and magnetism having a strong affinity for oxygen; may it not be possible for the first to be hereafter employed as a cheap substitute for fuel in the operations of the kitchen, and the latter as a cheap and expeditious power in the process of bleaching, while from the powerful union of the two what splendid results may not be anticipated.

The great discovery of Davy through their means of the composition of alkalis and earths, has already led to their application in Mexico, as the most economical and expeditious mode of extracting silver from its ores; and when cheaper and more efficient means for producing electro-magnetism, as well as more capacious reservoirs for retaining it, are arrived at, may it not be equally beneficially resorted to in the reduction of other metals from their ores, as well as in many useful purposes connected with the arts, and even the more common purposes of life?

Should electro-magnetism be readily elicited by the sudden compression of air, the hollow cylinder and piston, by being capable of extension to any size, would be consequently capable of furnishing it to any amount, by the simple extension of their capacities; while as glass is not considered superior to silk and resin, as an insulating medium, there is no reason why the latter should not be employed, by which a jar might be fabricated capable of containing electro-magnetism to almost any amount. By covering a jar of tinned iron with resined silk and a coat of tin foil over, having the interior filled with tinned iron partitions for giving greater surface, a battery might be made of such power as to defy human calculation; for the size being almost unlimited, the power thereof would be almost unlimited also. A battery in fact might be constructed as large as an ordinary house, capable of rending rocks and shivering trees to atoms, or of giving a shock sufficient to produce a local earthquake, and shake the containing edifice to the foundation.

With reference to the motion of comets, it has occurred to me since the printing of the foregoing sheets, that as the greatest attraction exists in the portion of the sun's zones adjoining his equator, the comet's course will be thereby directed toward the latter, while if an electro-magnetic comet, and consequently possessed of a tail, the attractions of the opposite zone of the sun upon this, will tend still further to incline it toward his equator, and thence into the hemisphere from whence it is to be repulsed. If, therefore, the motion of a tailed comet be slow on approaching the sun's equator, the tail will naturally be deflected toward the hemisphere eventually repelling the head by the attraction of this hemisphere upon it.

ESSAY

II.

MAN AND HIS DISEASES.

INTRODUCTORY REMARKS.

THE singular relief afforded by the application of flour to a scalded foot, on board his Majesty's ship, Tyne, naturally excited my curiosity and set my mind at work, to find out the cause why it and cotton wool, both apparently inert bodies, should be productive of such sudden and decisive benefit in burns and scalds. That this benefit could not solely be owing to the exclusion of air, seemed evident, from both cotton wool and flour being too porous to effect this; when a thought struck me that it might arise from their non-electric conducting qualities, by which they would exclude the atmospheric electricity from the diseased parts. Seeing that should this view be correct, the same applications would give the same relief in all local inflammations, I consequently tried the effect of cotton paddings upon these, as well as upon bruises, pulmonic pains, &c., and uniformly found a similar relief to accrue. Following up this inquiry, I perceived that the similar relief by blisters, cauterisations, and plasters to pained parts, as well of dressings to sores, could be explained on the same insulating principles, seeing that the substances applied were either non-electric conductors, or converted the skin into a non-conductor by oxidating it.

While experimenting in this way, I was consulted by a female at Islay, Peru, relative to a tic doloreux of three years' standing, affecting the branches of the portio dura, the incessant torment of which had reduced her to a skeleton. The pain always commencing at the point where the nerve emerges before the ear, I forthwith charred the surface with caustic, and further insulated the part with a padding of cotton wool, when immediate relief ensued, and on my return, two months after, I found her fat and healthy. I had made no further advances in the above subject until perusing Sir John Herschel's Outlines of Natural Philosophy, in April, 1833, when the grand idea of Dr. Arnott's, therein referred to, of the brain being a great electric battery, opened up at once a new world before me, from the connexion thus pointed out between the above and the results of my previous investigations. Upon a due reflection therefore upon the subject, I was eventually led to the conclusion, that the proximate cause of all diseases is inordinate galvanic action, and that the activity of the remedies usually administered for the relief thereof is proportioned to the local intensity of the galvanic action excited by them, or, in other words, to the facility with which their constituents are decomposed by the galvanic placids, being, generally speaking, therefore, poisonous, emetic or purgative, according to the relative facility of their decomposition. Forty years have now elapsed since Galvani demonstrated the animal body to be a galvanic machine, therefore the only marvel is, that the cause of the bodily growth and decay should not hitherto have been ascribed to galvanic action, seeing as we do, the analogous changes it is capable of producing in dead matter, both animal, vegetable, and metallic, submitted to its influence, in the common experiments of the class-room. The above view relative to disease seems indeed fully exemplified by all the insulating remedies checking its local progress, as well as by the general remedies acting beneficially according as they diminish the intense galvanic action, by attracting the electro-magnetism, exciting it from the system, or causing a translation of it from one part of the body, or from one class of vessels to another. If we apply the solutions of sulphate of zinc or copper, or of acetate of lead, to the external parts of the body, or the black oxide of mercury (as in the black wash) to a sore, or mercurial ointment by friction to the skin, we invariably find the oxide in the above metallic salts to be gradually separated from the acid, and left adherent to the cloth or the skin, and the mercury in the mercurial oxides to be also more or less disunited from its oxygen, and left in globules on the surface of the sore or that of the body. If again we exhibit the sulphates of copper and zinc as emetics, we find them always more or less decomposed on ejection, while every medical man must have repeatedly witnessed the fact of the decomposition of calomel when exhibited as a purgative, in the dark tinge which its black oxide gives to the mucous evacuations produced.

There are many well-authenticated cases of mercurial globules being found in the bony cells after death, while deaths by lightning have a close resemblance to those by poisons, a rapid lividity, tumefaction and putrefaction of the body ensuing in both. The poisonous oxides and salts we find to be those whose constituents have the weakest affinity for each other, and are consequently the most easily separated by galvanic influence. Thus metallic oxides and metallic salts are, generally speaking, more and more active in their operations in proportion to the amount of acid or of oxygen united with them, from the acid as well as the oxygen having a less and less affinity for them in proportion to the quantity of either which the above salts or oxides contain ; so that the easier the operation of their constituents by galvanic influence, the more intense will naturally be the galvanic action produced. Thus the sub-muriate of mercury, containing about four per cent. of oxygen in its oxide, operates in a four grain dose as a salutary purgative, while the muriate, containing about eight per cent., operates in the same dose as a violent poison.

We see a good exemplification of the mode of action of metallic poisons in that of the nitrate of silver, an easily decomposable metallic salt, a sort of effervescence taking place on its application to the skin, which becomes speedily black from the oxide deposited upon it; and we have only to suppose this metallic salt applied to the coats of the stomach instead of the skin, to form a just conception of the mode in which most poisons act. The deadly consequences of the inhalation of carbonic acid into the lungs, are doubtless also referable to the intense galvanic action excited there: the body after death from this gas, pourtraying the same appearance as when destroyed by lightning or the stronger poisons; rapid swelling, discoloration, and putrefaction ensuing, while the burning heat in the breast and windpipe is similar to that experienced in the stomach from arsenic. It seems an *extraction* in intensity of the electro-magnetism of the vital parts, by which their organic structure is as effectually destroyed as it would have been by an intense electro-magnetic *introduction;* there being no difference in the living body between a burn and a chilblain, or in living vegetables between a frost-bit ear of corn, and a sun-singed one.

To the above intense electro-magnetic extraction may also be ascribed the frequent fatal effects of a draught of cold water in an over-heated body.

CHANNEL OF ELECTRO-MAGNETIC INTRODUCTION.

THAT certain species of food and drink supply atomo-electricity to the body is evident from the heating effects that many of these produce; but the body being capable of heating itself in an intense degree by exercise alone, shows that the above are not the only mediums of electric introduction. The general belief is that respiration is the great channel through which electric heat is conveyed; but if we rely upon our own feelings, we will find that it diminishes instead of increases bodily heat. When we are overheated we breathe quickly, which nature could never have intended to increase that heat of which there is already too much; on the contrary, our feelings tell us that respiration is a cooling as well as an exhausting process, while, when we wish to keep warm in a cold winter air, we hold in our breath, or breathe through the folds of a handkerchief to prevent the air, which we find *chills* our body instead of *heating* it, from rushing in too rapidly upon the lungs. Dogs indeed, that for very wise reasons perspire almost solely by the mouth and tongue, open wide their mouths, loll out their tongues, and breathe quickly, as the only medium of *cooling* their bodies. The lungs, therefore, seem to be the great safety-valves of the body, the main channel through which the electricity and magnetism, after performing their various important functions, are conveyed off by the attractions of the nitrogen and oxygen inhaled at each atmospheric draught. We see here a wise dispensation of Providence in the amount of oxygen in the atmosphere being only one-third of that of the nitrogen; for were they equal, the atmospheric air would act as a poison to the body by the intensity of the galvanic action which this equality would admit of being excited in the system. If again nitrogen only were contained in the atmosphere, the body would be over-chilled by the nitrogen carrying off the electricity, and leaving the magnetism, finding, as we do, that the breathing of pure oxygen, by carrying away the magnetism which *cools* the body, and leaving the electricity which *heats* it, causes death by over-excitement, or, in other words, by the general inflammatory fever produced.

As the body, therefore, cannot receive a sufficiency of electro-magnetism through the medium of food, and none can be received through that of the lungs, it must receive it through the only other channel left, viz. the skin. That electro-magnetism passes readily through the skin we know from the rapid transmission of that of the electric and galvanic batteries through it, from the frequent deaths by lightning, and from the readiness with which atomo-electricity heats the whole body, when the surface thereof is exposed to its influence.

Electro-magnetism is most readily attracted, as well as carried off, by pointed substances; and hence the readiness with which the human body is heated or cooled by simply exposing the hands or the feet (pointed substances) to the fire or the cool air. The hair is also a pointed substance, and as nothing was made by the Great Creator in vain, we may be assured that *use* and not *ornament* was the purpose for which it was intended, and that the above purpose was that of transmitting electro-magnetism to the body, our own feelings as well as reasoning from facts daily presented to our view, sufficiently convince us of. To what else are we to ascribe that writhing and creeping, as well as bristling-up kind of sensation in the hair of the head, universally felt, when strong emotions move us, and so frequently alluded to by poets, and pencilled by painters. To what else can we ascribe the curious fact of every diseased blotch or pimple in cutaneous affections having invariably *a hair in its centre*, or of the hair of the head being bleached white by great mental emotion in a single night, a circumstance so analogous to the destruction of vegetable colours by the electro-magnetic currents of the galvanic trough, as to leave scarce a doubt of the hair owing the sudden destruction of its colour to similar currents rushing through it. We perceive in fact hair to prevail upon, or in the vicinity of parts in proportion to the importance for which they were designed, the head and face being most intensely covered, as appertaining to the most important organ of all, the brain, and the pubis the next so covered, as appertaining to the organs next in importance, viz. those for procreating the species; while the organs of sight, of hearing, and of smell, are all equally characterised by the long and bristly hairs surrounding them.

The depressing emotion of fear, from the paleness and cold shivering, as well as the bristling-up sensation in the hair which it produces, is evidently owing to the *escape* of electricity from the body, while that of joy and other similarly exciting emotions, by their heating and flushing effects, are in like manner evidently owing to the *entrance* of electricity into the body, because electricity being the power which produces heat, its intense escape will naturally chill and enervate the body as much as its intense entrance will flush and invigorate it. From the attractions of electricity and magnetism for bodies being the reverse of each other, it may therefore be concluded that the power of bodies to conduct them, must be the reverse of each other also; seeing that this power of conduction (as I have demonstrated in the early part of the work) must depend upon the attraction of the conducting bodies for the substances which they conduct, so that good electric must be bad magnetic conductors, and *vice versa.* All *dark* coloured bodies having, therefore, a *strong* attraction for atomo-electricity, must consequently have a *weak* attraction for atomo-magnetism, making them thus *good* conductors of the *first*, and *bad* conductors of the *last;* while again *light* coloured bodies having a *weak attraction* for atomo-electricity must, for the same reason, have a *strong* one for atomo-magnetism, rendering them good conductors of the latter, and bad conductors of the former. Dry wood being a bad, and moist wood a good *electric* conductor, so also dry bodies I conceive will be good, and moist bodies bad *magnetic* conductors. From the above, therefore, the *colour*, as well as the state of *humidity*, of the hair must have great influence on the human temperament by the different amounts of electricity and magnetism, which the different grades thereof are capable of conducting into the system, a conclusion sanctioned by the observation of all ages as to the colour of the hair influencing the disposition.

The different coloured rays of the sun containing (as I have previously exemplified) different proportions of electricity and magnetism, therefore different coloured hairs will naturally attract the rays corresponding to their colour, and thus render the temperament either a warm or a cold one, according to the respective amounts of electricity and magnetism which they are capable of conducting. Red-haired people have always been as noted for possessing warmer passions than those with other coloured hair, as the red rays of the sun have been for containing more atomo-electricity or heat than any other description of his rays, the white hairs of the Albino youth pourtraying, on the contrary, a temperament *naturally* cold, and the white hairs of old age, one made *artificially* so through the blanching of them from long continued electro-magnetic action; attracting the cold, pale-coloured rays of the sun according as they assimilate to them in tint.

BRAIN AND NERVES.

Although by the ready introduction of electric matter through the medium of the skin, as before exemplified, it appears evident, that local parts derive much of the electro-magnetism which retains them in health, or pushes them into disease, from *external* sources; yet some great internal reservoir must be required to supply the above when external sources fail, as well as to give a leading direction to all those energies primarily derived from internal impulses, or, in other words, from volitions of the mind. That the brain is this great reservoir our internal feelings tell us if nothing else did; while our external senses similarly point it out as the great centre to which all their currents tend—those senses by which we judge and form our opinions, viz. the senses of hearing, seeing, smell, and taste, all of which are concentrated round this great centre, for no other seeming purpose except that of a more speedy and intimate communication therewith. Mass-electricity and mass-magnetism, however, being contained principally on the surface of bodies, therefore we may conclude that it is contained principally on the surface of the brain, and that of the various lobules and cells into which it is divided, so divided in all likelihood for no other purpose except that of containing a large electro-magnetic amount in the least possible space. The brain being a fatty substance, and fat being a bad electro-magnetic conductor, we may presume that the membranes are the containing bodies, the brain merely serving as their insulator, to prevent a too promiscuous communication among the various organs of the head, by which their diverse functions might be less distinctly as well as less energetically pourtrayed. The nerves being mere prolongations of the brain must necessarily be the ducts along which the electro-magnetic current poured out from the brain is conveyed; the pia mater being, in all probability, the membrane conveying it from (as well as of containing it in) the brain; while being conveyed along the outside of the nerves, they will thus be able to convey it in a larger mass as well as with less risk of injury to their structure than if their more internal parts had been made the medium.

The voluntary nerves are large and have few ganglia or plexuses, because the volitions of the mind through the electro-magnetic current requiring to be powerfully as well as quickly conveyed, large channels, free from all retarding obstacles, are consequently required so to convey them.

The involuntary nerves, on the contrary, are small, have numerous ganglia and plexuses, and communicate with almost every nerve of sense, or division of the brain; because the electro-magnetic current to be conveyed is small, and consequently small ducts suffice to convey it: its impetus at the same time requiring to be checked by the retarding attractions of ganglia and plexuses, to prevent its too intense rush upon the vital parts; while an extensive system of sympathetic communication is demanded between these vital parts and every division of that great centre of sympathy, the brain, as well as with the nerves conveying the external sympathies thereto, in order that those vital parts, on which all others are dependent for vital sustenance, may respond to every call which the brain makes upon them for a supply thereof to the parts of the body requiring such, over the whole of which parts it exercises so supreme a control.

The smallness of the origin of the vital nerves in the brain, and the retarding action of the ganglia and plexuses upon the electro-magnetic currents, will also prevent the will from exercising a direct influence over the vital parts; an influence which would necessarily tend to endanger life, by placing it under the unchecked control of all the passions and emotions to which the mind was exposed; and I doubt not but a dissection of those recorded to have been able to stop the action of the heart at will would have shown the origin of the sympathetic in the brain to be unusually large. That electricity is in considerable excess over magnetism in the human body, is evident by the general high temperature which it maintains; while considering nitrogen as carrying off the superfluous electricity, and oxygen the superfluous magnetism, we may presume that they were wisely apportioned in the atmosphere to the respective amounts of electricity and magnetism which the body contains. The nitrogen being double the amount of the oxygen in the atmosphere, it may be concluded that the amount of electricity in the human body is double at least that of the magnetism. The amount of electricity will thus be double also that of magnetism on the superficies of the brain; and as they always occupy opposite sides of bodies, they will in all likelihood occupy opposite superficies of the pia mater, and consequently move along the nerves in the same way, unless it may happen that one moves along the inside of the dura mater and the other along the outside of the pia mater.

MUSCULAR ACTION.

An increase of electricity in bodies causing them to expand and a diminution of it in them to contract, so to an alternate increase and diminution of electricity in the muscular fibres, muscular actions may be ascribed, seeing that in the human body in a state of health, electricity exceeds magnetism, and therefore must render the latter subservient to its inclinations. The will has sufficient power to regulate the actions of the voluntary muscles, by impelling the electricity into one set while withdrawing it from another, and by this means cause an alternate elongation of the one and contraction of the other, thus enabling the various voluntary muscular actions to be effected. We find, however, that all powerful exertions of the voluntary muscles require to be assisted by drawing a full draught of atmospheric air into the chest, which, by its affinity for electro-magnetism, attracts that of the contracting muscles towerds the lungs, and thereby enables a stronger muscular contraction to be effected, than could be effected by the will alone. A curious example of this power of an atmospheric inhalation over the electro-magnetism of the human body is shown in the singular ease with which one person may lift another from the ground, by making the effort at the moment of drawing in the breath, which attracting the electro-magnetism of the body toward the lungs, thereby diminishes the body's hemispheric attraction, or, in other words, its weight. To attain, however, this point, the person lifting must inspire at the same instant as the person lifted, otherwise the electro-magnetism of the former will flow into the latter, and thus in a great measure neutralise the effect aimed at. The action of the heart and arteries depending but little upon the will, a different system of machinery is consequently required to carry it on. I have before shown that white bodies are bad, and coloured bodies good electric conductors: consequently, while the red muscular parietes of the auricles and ventricles are good conductors, the *white* tendinous partitions separating them are bad conductors; so that the electricity is insulated in the above parietes until its quantity is sufficient to overleap, as it were, this tendinous barrier, and enable it to pass onwards. On the electricity therefore being poured by the great sympathetic nerve into the muscular parietes of the right auricle, the latter will consequently expand, thereby dilating the auricular cavity, and enabling the venous blood to flow freely into it. While, however, this expansion is taking place in the auricle, its adjoining ventricle is undergoing a corresponding contraction from its electricity passing onwards to the left auricle, leaving the right ventricle thus in a fit state to attract the superabundant electricity from its auricle, and so transmit it onward through the left auricle and ventricle of the heart, and finally through all the vessels of the body, carrying the blood at the same time along with it in its progress by the vascular contractions and expansions which it excites.

FŒTUS.

In coition there seems to be a reciprocal exchange of electricity between the male and the female, according to the reciprocal diminution or excess of their respective excitements, until by the progressive exhaustion of the mass-electricity of the body, by its probable conversion into atomo-electricity, the muscular fimbriæ of the Fallopian tubes and the fibres of the seminal vesiculæ are impelled to contract, and thus expel the ovum and semen from their respective recesses.

The semen is pale, and consequently will have an affinity for magnetism, while the ovum is red, and will have an affinity for electricity; the two therefore constituting a compound well calculated for the excitement of galvanic action. As atomo-electricity, or heat, is essential to the growth of all living substances, we may conclude that it is the immediate or proximate cause of their growth; while atomo-magnetism, or cold, arresting their growth, and eventually destroying them when applied in excess, we may conclude therefore that it is the proximate cause of their decay. Electricity is thus a creative, and magnetism a destroying principle, according as one is in excess over the other in the substance operated upon; so that electricity being in excess over magnetism in the human body, its influence will preponderate, and a progressive increase in the ovum consequently ensue. On the deposition thus of the ovum and semen in the cavity of the uterus, the electro-magnetism of the latter will be attracted toward them, exciting inflammatory action in the inner uterine coat, by which an adhesion of the ovum to it will naturally be effected, when the electro-magnetic current having now a direct communication therewith, the uterine inflammation will naturally abate from all the electro-magnetism requisite for the ovum's growth passing readily by this route. The increase of the living ovum by electro-magnetic currents will naturally be effected in the same way as we perceive dead matter to be increased by the above currents, depositing, as they do, the matter attracted in their course at the extreme points of the conducting wires, and therefore we may presume the vessels conducting the electro-magnetic currents in the human body will similarly deposit the matter attracted in their course at their extreme points also.

Electricity being in excess over magnetism will therefore be more powerfully attracted, and from this more powerful attraction made to move onward in straight lines, and the magnetism in spiral, from the weaker as well as the slower moving bodies being always more easily affected by the attractions of collateral bodies than the stronger or the quicker moving. This we see exemplified in the direct motion of smoke from the centre of a gun, and the spiral motion of that from the sides, so that the longitudinal fibres of vessels will be formed by the electric currents, and the circular fibres by the magnetic currents; a conclusion strengthened by the fact of the longitudinal fibres in blood-vessels, as well as in the bark of trees, always being darker-coloured and stronger than the circular. These electro-magnetic currents will necessarily pass through solids in preference to fluids, in consequence of the first being the best conductor, and hence they will naturally form solid vascular conduits for their own conduction as they progress with the development of the fœtal parts. All living substances, whether animal or vegetable, invariably incline to a circular structure in their grander as well as minuter developments, when each does not militate against the great purposes for which they were designed, the circle being found the strongest of all structures for resisting either external or internal pressure.

When these circular structures are tubular for the purpose of conveying a fluid, the fibres of their inner coats are always found to be circular, and consequently owe, as I have before endeavoured to illustrate, this circular form to the spiral magnetic currents which they were destined to convey. As the magnetic atoms attract each other at near distances, and repel each other at more remote, the magnetic current therefore flowing along this inner coat, while *attracting* its *sui generis* atoms in immediate contact, will repel those in the opposing portions of the circle, and by this repulsion will predispose to the progressive enlargement of the tube according to the increased amount of magnetism flowing along this inner coat. The same views will hold good with the other vascular coats, whether they be magnetic or electric, and therefore according as one coat increases either its thickness or circumference, the others will be proportionally increased also, as long as a healthy electric action is maintained throughout them. As the fœtal vessels however increase their diameters, they will be enabled to conduct onwards a greater and greater amount of electro-magnetism, and consequently also of the matter which the latter conveys for the forwarding of the fœtal growth, as well as for the farther enlarging of these conducting vessels, when increased demands render increased supplies necessary; and so this enlargement of all the uterine contents progressively proceeds, until every portion of the child is so fully developed as to fit it for the new state of existence it is shortly destined to encounter. Mass-electro-magnetism being contained on the surface of bodies, the uterine membranes therefore will serve as great reservoirs, from whence the necessities of the ovum may be supplied when the electro-magnetism of the female body is deficient: at the same time serving as a safety valve to guard against those mental emotions through which the life of the infant might be endangered, by their receiving of any electro-magnetic excess directed toward the latter.

The fœtal increase is at first slow, because its uterine communications are then small, naturally progressing however with the increase of the latter. Toward the fourth month this increase is so rapid, that the fœtal life might be endangered by excessive action, did not the uterus at this time come in contact with that sensitive organ the stomach, so that a portion of electricity being drawn from the latter to aid the excessive fœtal growth, a contraction of its muscular coats naturally ensues, by which its contents are ejected. Vomiting, acting like rotation in ejecting electro-magnetism from the body, by such simple means the fœtal growth therefore is checked, and the electro-magnetism now introduced applied more to the perfection of parts than to the further enlargement of them. At last the uterus expands to such an extent as to press uneasily upon all the surrounding parts, from whence it occasionally draws electricity, causing thereby painful twinges and spasmodical contractions, till the fœtus becomes too large to derive its whole electro-magnetic supply from the female body, without diminishing to too great an extent that of the latter; this great diminution consequently producing such unremitting contractions in both the uterine and abdominal muscles, as ultimately to expel the fœtus from the body.

I have before illustrated that when electricity is in excess over magnetism, in both living animals and vegetables recrementitious action preponderates, and when magnetism is in excess over electricity, that excrementitious action preponderates: tending thus to an increase of the body's bulk in the first, and to its decrease in the second.

Electricity having a strong affinity for coloured bodies, and magnetism for pale, consequently the first will naturally prevail in the red-coloured solids and fluids, and the latter in the pale, which respective appearances in both may indeed be produced by the very electricity or magnetism which they contain. The vessels carrying red fluid must necessarily, I conceive, be invariably recrementitious, and those carrying paler fluids excrementitious in proportion to the paleness of their contents. That light coloured fluid, the chyle, probably derives that extra electricity, and that red colour imparted thereby, after it mingles with the blood, to the electricity conveyed through the skin, the blood being the reddest and warmest of all the animal fluids, as the red rays of the sun are the warmest of his rays. We may indeed set down the fluids as progressively recrementitious according to their progressive increase of colour, or *vice versâ*, as excrementitious according to their progressive paleness, as we find the sunbeams to be progressively warmer or colder according to their progressive redness on the one hand, and paleness on the other. On speaking of electricity being conveyed by one set of vessels, and magnetism by another, I mean only that electricity is conveyed in excess in the first, and magnetism in excess in the second; because in none of the sun's beams refracted by the prism do either electricity or magnetism stand alone, being always conjoined with each other in varying quantities.

Conception being an excrementitious action as far as the female is concerned, hence poor animals are better breeders than fat ones, it being as often requisite to reduce an animal by low diet or purging to make it breed, as it is by similar means to make a hen lay; the same view also applying to fruit trees, which are unproductive in rich soil from the powerful recrementitious action thereby excited in the tree only increasing its bulk, and therefore require to be removed to poor soil, or to have straw, sand, or stones, bedded round to moderate the penetration of the heat, and thereby moderate also the excessive recrementitious action on which their barrenness depends.

It is after the human female has menstruated, that she is inclined to the embraces of the male, as well as fitted to conceive; whilst it is at the very period of menstruation in quadrupeds that the female is inclined to a connexion with the male, or fitted to conceive. As we find the fœtus to be fashioned out of the ovum of the human female, we may consequently conclude that in the quadrupeds spoken of it is fashioned from the semen of the male, such being the case in birds, the females of which come in season at the period of laying, and copulate with the males only then. The males of the elephant and camel species coming in season instead of the female, and only copulating with the latter at the above period, I conceive therefore the fœtus in their case must be produced from the female semen also. The female recrementitious ovum in the human species being impregnated, as it is termed, by the magnetic excrementitious semen of the male, I think it probable that many other excrementitious fluids, serous and mucous, would so impregnate it; and that in this way extra-uterine conceptions, as well as conceptions when the male semen could not possibly reach the ovum *in utero*, may be accounted for. There is a singular species of elucidation of the affinity between electricity and music, in the sex of the animal furnishing the electric or recrementitious substance in the process of generation having always a more musical voice than the one furnishing the magnetic substance; the voice of a woman being as superior in musical sweetness to that of a man, as the notes of male birds surpass in melody those of the females.

INFLUENCE OF THE MIND ON THE FŒTUS.

THE belief of objects influencing the fœtal growth and appearance through the medium of the mind, is too deeply in accordance with human feeling ever to be shaken by any theory however plausible. It is indeed as old as the days of Jacob, when he placed the peeled rods before the conceiving flocks and herds, and thereby engendered a motley-coloured progeny; and if we dispassionately examine it, we shall find more and more reason to appreciate its justness. It is in fact nothing more than a manifestation of that influence which the mind, either directly or indirectly, exercises over every action, voluntary or involuntary, intellectual, mechanical, or chemical, in the human body. We excite the voluntary muscles to direct action, because the involuntary nerves have large communications with the brain, and are consequently capable of powerfully rousing the parts with which they are connected, by the energy of a single impulse, while the communications of the involuntary nerves with the brain being small, and the motion of the electro-magnetic current conveying the impulses also retarded by the influence of ganglia and plexuses; consequently the lesser energy of the impulse, as well as the retardation thereof, conduce to that deception we popularly labour under, of the will not exercising its influence over the heart, stomach, intestines, &c., the same as over the voluntary organs. In the involuntary organs, something like a forcing power is requisite to make the mind's influence sufficiently apparent, such a power as our passions or our fears conjure up; the heart, the stomach, the intestines, and, in fact, the minutest functional part being eventually influenced thereby, in proportion to the intensity or continuance of that power. Thus, joy, anger, surprise, and fear, all primarily agitate our hearts by quickening, diminishing, or rendering irregular its action,—sickness and vomiting probably next ensuing, according to the nature of the mental impression, even the intestines and bladder being ultimately affected in cases of great fear, causing an involuntary discharge of their contents by the escape of that electricity on which the expansion of their muscular coats depended. The very thought of eating fills our mouth with saliva, while shame and anger flush our cheeks, and fear blanches them; all in obedience to that indirect mental impulse we all feel, but the theory of whose action defies all our powers of unravelment. While warmed by the visionary contemplation of imaginary objects, we feel every thing thus pictured forth thrilling through us in intensity, proportioned to the exciting, soothing, or saddening sensations to which they give rise. We can in the mind's eye picture forth imaginary fields we intend to ornament, or houses to build, and I doubt not, were it permitted us to have the whole arcana of the mind tinted out in panoramic outline before us, we would find every object pictured forth before the mind's eye—pictured forth also in electro-magnetic colouring upon the portion of the brain destined for such impressions. The direct or indirect influence of the mind being such over all the feelings and functions, I see no just reason, therefore, why the same influence should not similarly affect the great function of the uterus in the moulding of the fœtus. In what other way can we account for the resemblance of the infant to the father or mother, or to particular relatives whom the mother has been interested about, and consequently would have oftener in her mind's eye? and why should we not extend the same principle to every other object that moves her deeply during the early months of gestation, before the fœtal form was perfected?

Form, feature, colour of hair, as well as preternatural marks or mouldings, may all, I conceive, be produced by objects moving the feelings of the mother strongly during the above period. If she think much about the husband at this time, the child will be disposed to resemble him, and if much about herself, to resemble her; but as every object of nature that powerfully excited her would tend to similar results, I would therefore conceive the resemblance of a child to any other person beside the husband, as no more a proof of the mother's infidelity, than the various blemishes or deformities that might disfigure it. Hence the feeling seems founded in reason, which prompts husbands to comply with the fancies of their wives during gestation, as well as to guard against their witnessing any horrifying sights which might tend to disfigure the infant.

The different proportions of electricity and magnetism existing in the atmosphere at the period of the fœtal formation of hair and feature, will also have an influence thereon. Thus we find the hair and eyes of the mixed Gothic race born in the West Indies almost uniformly dark, while those of the same race, born in the polar regions, are more or less light-coloured, from electricity being superabundant in the first region, and magnetism in the second; and thus each forming the hair and eyes of a colour in accordance with its own affinities. It is as much to the natural superabundance of atomo-magnetism in the atmosphere, as to its intense reflection from the snow, that we may attribute the turning white of the coats of animals during the polar winters, a magnetic influence as destructive to the colouring matter of the eye as it is to that of the hair: snow blindness and moon blindness being both referable to a blanching of the pigment of the eye by the atomo-magnetism reflected from the above bodies. If we carefully investigate into the causes of the different coloured hair and eyes of children, we may hereafter find that much of the above depends upon the earlier fœtal development being in summer, or in winter, or even when snow was upon the ground, or magnetico-epidemic diseases prevailed, the electric prevalence tending to darken, and the magnetic to whiten, every susceptible body exposed to their influence.

HEMISPHERIC INFLUENCE ON FORM AND APPEARANCE.

THE northern hemisphere being surrounded with a zone of mass-electricity, which will naturally repel atomo-electricity, and attract atomo-magnetism; while the southern hemisphere being similarly surrounded with a zone of mass-magnetism, which, on the contrary, will repel atomo-magnetism and attract atomo-electricity, consequently each hemisphere must exercise a different influence upon animal and vegetable existence within its sphere, and thus vary essentially their form, constitution, character, and colour. Thus atomo-magnetism being attracted and atomo-electricity repelled in the northern hemisphere; low situations will therefore be more under the magnetic influence than the high, and high situations more under the electric influence than the low; while in the southern hemisphere the above influences will be reversed from its electro-magnetic attractions and repulsions being the reverse of the northern. Atomo-magnetism being thus more equally diffused through the southern atmosphere than the northern, and atomo-electricity more diffused through the latter than the former; this more equable electric diffusion will tend to darken the colour of every living thing in the northern hemisphere, the same as the more equable magnetic diffusion in the southern hemisphere will tend to blanch the colour of every thing there. By each entering also in greater quantity into the constitution of living animals and vegetables in their respective hemispheres, a greater activity of circulation and vigour will be conferred thereby in the northern hemisphere; while in the southern both animals and vegetables will be made in some measure to approximate the colder blooded animals in their lessened activity and more sluggish circulation. This greater abundance of magnetism in the food and greater diffusion through the atmosphere in the southern hemisphere will tend to produce the following results upon the progeny of the natives of the united kingdom, emigrating there. Those of the mixed Gothic race (as shown by fair hair and black hair existing in the same family) will become fairer in hair, eyes, and complexion, than their parents, their blood colder, their feelings and passions less ardent, have more placid and more tractable dispositions, better understandings, be more persevering and industrious, not so easily provoked, but when once so their anger will not be so easily allayed. They will, however, be less fitted for those great purposes dependent upon intense mental energy; so that they will produce no poets equal to those of the north, though in all pursuits dependent upon reason they will equal if not surpass; their southern youthhood, indeed, approximating the middle stage of life in the northern hemisphere, where grey hairs make magnetism preponderate more in the body, so that the dark-haired southern youths will approximate in disposition to the fair-haired Gothic race of the north.

Electricity, again, being the recrementitious principle, the reverse attractions and repulsions of the hemispheres upon the electricity of the body will consequently tend to produce reverse effects in the upper and lower parts of the latter. In the northern hemisphere the electricity will be repelled from the lower parts of the body toward the upper, thus tending to increase the size of the latter at the expense of the former; while, in the southern hemisphere it will be attracted from the upper extremities towards the lower, thus tending to increase the size of the last at the expense of the first. The above remarks, founded, I conceive, on just inductive reasoning, are, in a great measure, borne out by a comparison of man as well as of living animals and vegetables in the two hemispheres. In New Holland, the descendants of Englishmen have verified the Tartaro-Gothic origin of their ancestors, by their generally small blue eyes and chins, fair hair, broad faces, and jutting cheek-bones; while their heads and chests are inclined to be small, and their pelvis and lower extremities large. The South Americans being generally descended of a dark-coloured race, the bleaching process cannot, consequently, so readily alter their hair in youth, although tending to make it earlier grey than in the north; but being more indolent, the tendency to increase the lower parts of the body at the expense of the upper is more signally marked than among the Australians; the feet, however, being comparatively larger in the north on account of the greater top weight which they have to support. Though this greater comparative size of the lower extremities in the southern hemisphere be far from universal, yet it is still so very general, and at the same time so prominently conspicuous among South American natives, that no stranger can visit the country without having it forced at once upon his attention. The men, from, I suppose, their more active life, show but little evidence of the above in comparison to the women; many of the latter having legs truly elephantic, and a pelvetic circumference and obesity only equalled among the South African tribes. It is singular, however, that some parts of the country seem more subject to the above than others; but whether this be owing to a difference in the local hemispheric attraction or to a difference in the mode of life, I cannot venture to determine, but partly incline to the latter, from observing the Peruvian and Brazilian females, who loll the greatest part of the day with their legs horizontally stretched out in hammocks or on sofas, to exhibit comparatively little of the above feature to what the Chilian females do, who sit principally on chairs. It was remarked to me by the English merchants at Arequipa, that although the porters there would carry immense loads when fairly balanced on their shoulders, yet they were quite unable to lift a heavy one from the ground; while the Peruvian foot postmen daily perform journeys which no European could rival; all evidently owing to the great power in their lower extremities, which are as comparatively strong as their upper are weak, the reverse of what is usually the case in the northern hemisphere. Even the colour of the hair, according to its greater or lesser electric transmission, considerably influences the above reverse hemispheric tendencies; red haired people having comparatively smaller lower extremities and larger heads in the northern hemisphere than those with other coloured hair; while in the southern the red-haired have comparatively larger lower extremities and smaller heads, so far as

I have hitherto observed. All the southern aboriginal quadrupeds incline also to the colour, form, and character before pourtrayed, their coats being generally pale, their lower extremities large in proportion to the upper, docile when well treated, and obstinate when ill used. Even the progeny of the animals imported partake of the above characteristics, with the difference in the horses, that while those constantly de-pastured have usually large heads, those stable-fed have small, owing to the head being generally depending in the first and elevated in the second. The birds and butterflies of the south show also the magnetic influence in the more beautiful and delicate tints of their plumage and of their filmy wings; the northern birds, however, amply compensating for this in the deeper impassioned melodies with which they woo their mates in the pairing season, or the mellower melancholy tones in which they pour out their laments when the chilling blasts and the dropping foliage warn them of their season of love, revelry, and joy, being near the close. The sun's magnetic rays being the most delicate and beautiful, hence the effects of a magnetic atmosphere upon the plumage; while his electric rays being the most exciting, hence the influence of an electric atmosphere upon the energies of the animals within its sphere.

The southern trees correspond in all respects to the southern animals, being commonly evergreens, and having consequently a sluggish circulation, while their short thick stems and their wide-spreading branches, with leaves of pale green, testify in connection with the other to a strong downward electric attraction in the hemisphere in which they grow. It is doubtless to this more diffused state of atomo-magnetism in the southern hemisphere, in conjunction with its being the magnetic hemisphere also, that renders the wool, the cotton, and the silk thereof so delicately fine, the New South Wales wool being superior to that similarly produced in the open air in the northern hemisphere; and the same may be said of the cotton from that country, the Isle of France, and the Brazils, all in south latitude.

There is certainly an exception to this in the North American sea island cotton; but I conceive it will turn out that this has been propagated from southern seed, and is grown upon a light coloured magnetic sand soil, (the heavy sand of the northern hemisphere,) which, by its strong magnetic reflection, would tend to blanch, as well as to render more delicate, the woolly fibre. Reasoning upon the diverse peculiarities in form and colour produced in the northern and southern hemispheres, I conceive a great migration of the animals of one hemisphere has taken place into the other, by which that blending of the two, now more or less visible over the world, has been effected. Thus the migration of northern animals to the south, and of southern animals to the north, even in the present state of the world, would partly account for this, considering how much these animals might be modified by the transplantation, as has been shown to be the case with the human species. When we contemplate, however, the proofs left by the last deluge, we have reason to infer that a change was at that time effected in the poles of the world; and hence such of the aboriginal animals as escaped by wing or feet to the higher regions not inundated, would, after the deluge, re-occupy their former stations, and their succeeding generations become gradually inured to the change of climate that had taken place. I would thus claim as southern birds all the humming species, parrot and pigeon tribe, all the marsupial or pouched animals, as well as the camel and elephant species, the sheep, and the greater portion of the deer tribe; in fact, all animals with small heads and of a palish colour, hopping or bounding instead of running. Whoever has paid attention to the peculiarities of the camel, llama, and kangaroo tribe, must have been struck with the resemblance they have to each other. All the three species have a similar form of head and neck; the males of all come in season instead of the females, and all copulate by turning their heads from each other, and backing into contact, the backward projection of the member in the male rendering this necessary. I might also include the elephant tribe, on account of the smallness of its head in comparison of its body, and the male coming in season, which seems to be a peculiarity among southern animals, but know not whether it copulates in the same way. I would also claim the whole negro race as southern aborigines, their hair being so constituted and coloured as to resist powerfully magnetic transmission, and thereby protect them against its too intense effects; while the lesser temperature of their blood, but, above all, that striking pelvetic obesity which they still retain, even after long climatisation in the north, tend manifestly to a proof of their southern descent.

The above view is no way inconsistent with Bible history, because at the period this was written, and even down to the present times, the world, so called, was merely that portion of it then known to the writers; and therefore we may presume that the writer of Bible history, in speaking of the deluge covering the whole world, and of only one family being saved, spoke simply of the limited portion of the world then known to him, and of the fate of that portion of the white race from whom he claimed descent. The same reasoning applies equally to man, there being too decided a difference among various of the races ever to reconcile it to reason that all have sprung from the same stock. The writer of the early portions of the Bible, which treat of this matter, while giving the whole history of his race, would naturally presume his first parents to be the first parents of all the races of the earth, from the whole portion of the *latter* known to him being occupied almost solely by his own kindred stock, and with whose history only it may be supposed he was acquainted.

INFLUENCE OF HAIR.

THE hair being the chief medium through which electro-magnetism is supplied to the human body, hence the superior hairy structure of man gives him a muscular as well as intellectual superiority over woman, whose silkier hair and downy covered skin precludes a sufficiency of electro-magnetism being received or emitted when great intellectual or muscular efforts are demanded. Indeed all women of powerful understanding or strength are remarked to approximate man in this respect, having a stronger hairy development of face or body than the more effeminate portion of their sex, and from which, as relates to the face, they derive a greater advantage than man by their not pruning it down, and thereby curtailing its power of electro-magnetic introduction. The different colours and constitutions of the hair in different people must necessarily have an important influence upon the mind and the temperament, on account of the different proportions of electricity and magnetism which the above coloured hairs transmit, and the different rapidities with which they transmit them. In the woolly head of the negro, the Creator has drawn a distinct line of intellectual difference between the black and white races; for wool being a bad electric conductor, his brain is therefore supplied with but a bare electric sufficiency to make the mental line between him and the next order of animals broadly visible, while the abundance of straight regularly constituted hair over his body shows his corporeal powers to equal at least those of the white, inferior though his mental powers be. The curly state of his head hair is attributable, I conceive, to the above more difficult electric introduction, the electricity naturally twisting it about in the efforts to effect an entrance, and thus eventually regulating its form. If the negro race, therefore, are ever to be elevated much above their present state, it must be by submitting themselves to the tutelage of less woolly and curly heads than their own, as the better-haired Indians of Peru found it their interest to do with the golden-haired children of the sun, the value of whose hair they so highly appreciated as to endeavour to preserve it by severe laws prohibiting their incas intermarrying with any but the golden-haired stock. Black bodies having a strong electric affinity, by means of which they transmit electricity more readily than any other species of colour; hence dark-haired people, as well as animals, are observed to be hardier than the white-haired, from their bodies being kept in a more equable temperature, in consequence of the readiness with which electricity can be acquired and parted with; while the tardy escape of it through the bad-conducting white hair, is apt to throw the body into an inflammatory fever when any violent bodily exertions are made. The black-haired race will thus, also, be enabled to rouse their mental energies and passions more suddenly and to a higher pitch of excitement, as well as to cool them down again more rapidly than the white-haired, who receiving electricity slowly, are slowly excited, and by also parting with it slowly, are slowly cooled.

embrowned with a dash of the former, a great improvement would be effected in both; the Saxon would have more life infused into him, and the Celt more judgment and prudence; the former would be less easily trodden upon, while the latter would be less easily excited by cunning and callous fair-haired demagogues to outrage and rebellion.

The effects of intense electric transmission causing an early whitening of the hair of those addicted to much mental thought, or in whose minds grief or anxiety have sown their cankering seeds, is curiously exemplified by the head hair of man insulated by the hat retaining its colour longer than the hair not so insulated; thus the hair upon the temples and other parts not covered by the hat becomes grey much earlier than that over the places covered by it: the hair upon the latter, however, falling off much sooner, on account of the electro-magnetism which retains it in vigour, and for whose transmission it was solely formed, no longer obtaining a passage in sufficient quantity through it. In woman, on the contrary, grey hairs not only make their appearance less early, but are nearly equally diffused, at the commencement of the blanching, over every part of the head; on account of their more porous and airy head-dresses admitting a freer electro-magnetic access to every portion of the head hair. But this is not the worst as regards man, for as reason leads us to believe that the brain is divided into different parts performing different functions, which parts must necessarily receive as well as emit the electro-magnetism on which their excitements depend through their immediate hairy coverings, so by the insulation (imperfect though it may be) of these cerebral parts, they will not only be prevented from attaining that puberty, if I may so term it, which they would otherwise have arrived at, but have their functions impeded and weakened whenever covered by the hat. Every man must have often felt how much clearer his ideas flow when his head is uncovered than when his hat is on, which he instinctively finds necessary to lift up every now and then and give his hair a rub, in order to make them glide brighter and smoother along. Oily substances, by their electric attractions and magnetic repulsions causing electricity to prevail over magnetism in the bodies conducting the latter, hence the benefit which the hair derives by unctuous applications to it when it begins to dry up through long continued or intense electro-magnetic transmission, which fitting it to be a better magnetic conductor than an electric one, enables it now to conduct in greater quantity the very substance eventually destined to effect its destruction.

Bodies are good conductors in proportion to the continuity of their particles: an iron wire being a good conductor, but the same wire converted into filings, a bad one, even when these filings are placed in a continuous row, so that many substances which attract electricity strongly may not be able to conduct it well on account of the want of continuity in their particles.

Dry wood, a bad electric conductor, which is converted into a good conductor by being moistened, affords an exemplification of the superiority of moist hair over dry in electric conduction.

PHRENOLOGY.

THE science of phrenology is of old date, though never attempted to be carried to the minuteness it is done now. We see that the ancients always moulded their heads in statuary and painting of that form which they perceived most nearly embodied the species of intellectual perfection they endeavoured to represent. A good head and a bad head, a poetical and intellectual one, having been long common expressions among artists, doubtless derived from observing that the more prominent qualities of the mind, were usually indicated by a particular mould of head. I had taken little interest in phrenology until proceeding with the present essay, when I saw that as electro-magnetism always occupied the surfaces of bodies, it must consequently occupy the surface of the brain, and that as according to the views into which I had been led, electro-magnetism was the immediate exciting cause of all the mental and corporeal functions, the cerebral superficies must therefore require an extension corresponding to the amount of the electro-magnetism it had to contain, or in other words to the amount of activity in these functional parts.

But as it is consonant to reason that distinct functions should have distinct portions of the brain allotted for them, hence these cerebral functional parts will necessarily require an extent of cerebral superficies, corresponding to the proportioned intensity of the action they are called upon to perform; for as increase of healthy action operating upon any part causes an enlargement of that part, (as we see exemplified in the muscles,) so the increased activity of any particular cerebral function, by causing an enlargement in the superficies thereof, will necessarily cause also a corresponding enlargement in the cranial superficies covering it. As parts, however, yield readiest at the point where there is *least* resistance, so the skull, therefore, will yield more readily in an *outward* than in a *lateral* direction, to a force pressing from within, and hence cranial projections will naturally be produced, corresponding to the form of the cerebral functional parts which they cover. Of this development of cranial protuberances, even in manhood, I am well convinced by that of one in my own head, in the line of the sagittal suture, whose increase was for a time so rapid as to excite an uneasy sensation in the part, and which occurring at a period when my mind had been kept for a considerable time in constant agitation, in consequence of the deceptions practised upon me in a quarter where I had placed confidence, I therefore conceive the above enlargement must be some way connected therewith.

Nature indeed sufficiently pourtrays, in the head formation of those born with defective intellects, the truth of the general principles of phrenology, by the marked difference of cranial formation between these and the more favoured of the human race, as well as between the stupid idiot, and the crafty; the former having, almost uniformly, large puffy heads and faces, while the heads and features of the latter assimilate, like their manner, very closely to those of a monkey. Indeed I never knew even an approximation to a monkey form of head or feature, which did not indicate a monkey disposition—cunning, trickiness, revengefulness, callousness, all even to the minutiæ of muscular attitude and expression being developed in the person's conduct. Knaves, in fact, (as far as my observation goes) possess no natural intellectual developments that would ever be turned to high account by any course of schooling, however judicious, and therefore society would suffer no loss by a total extinction of the breed; but if you can only restrain the *increase* of their *noxious* developments, so as to make them less pestiferous, you will accomplish a great good: an aim which may hereafter be much assisted by the lights that phrenological science seems destined to throw upon the subject.

The common reproachful terms of thick-skull and big-head have some foundation in reason; a thick skull necessarily retarding the inflow and outflow of electro-magnetism to and from the brain, by the greater mass of substance it has to pass through; while a big head indicates a similar retardation somewhere, by which the electricity received is applied toward the cranial enlargement; which electricity being more generally applied to the enlargement of the *animal* than the *intellectual* portions of the brain —hence the general justice of the remark. It is, however, by this enlargement that the larger heads of the fair-haired race are enabled to compensate, for the tardier electric introduction into them, in consequence of the larger reservoir *within*, from whence they can draw electro-magnetism, without being always dependent upon *extraneous* supply. Those whose hair readily emits and receives electro-magnetism can better dispense, therefore, with large heads; but I think it will be found that men of great talents have almost uniformly large heads, from a large reservoir being required in the head for storing up electro-magnetism, in order that, when occasions call for it, there may be enough at hand to prevent grand conceptions from being mutilated by a deficiency of supply from without.

NUTRITION.

THE analysis of human food shows it to consist, generally speaking, of nearly equal proportions of oxygen and of the inflammable matters, carbon and hydrogen; from which it might be inferred that magnetism and electricity must be attracted inwards through the skin, for the purpose of decomposing, or, in other words, of digesting it. Should, therefore, magnetism and electricity in equal proportions neutralise each other, no increase or decrease of temperature would take place in the human body from the digestion of the greater portion of the food made use of: this food requiring oxygen in excess over combustible matter to cool the body, and inflammable matter in excess over oxygen to heat it. Now as certain species of food and drink are heating, and others cooling, they must, I conceive, contain either mass-electricity in excess or mass-magnetism in excess, in order to produce these heating or cooling effects, because, during their decomposition, the mass-magnetism and mass-electricity which they contained would be in all likelihood set free from them in the atomic state, and thereby increase the body's temperature or diminish it according as either preponderated. But as electricity and magnetism in equal proportions may be capable of exciting the sensation of heat, and as a body which is the heaviest in the northern hemisphere may be lightest in the southern, so the conclusions relative to the above must remain in a great measure speculative until farther experiments enable more correct results to be drawn. That electricity and magnetism are attracted inwards through the skin to assist digestion is not only borne out by previous illustrations, but by our own sensations. When digestion is going on, we feel uneasy if our clothes are tight about us, consequently are instinctively led to slacken them, thus admitting the atmospheric air, and consequently the atmospheric electro-magnetism, to have freer access to the skin. Again, hot drinks do not produce such lasting heating effects upon us as cold drinks, because the electric heat they contain passes only from *within* the body to *without;* while the cold drinks, on the contrary, attract their electricity from *without* to *within,* and as it will have to pass *outward* again, it will thus by the *double* course it has to pursue, increase the body's temperature for *double* the time at least that the hot drink can so increase it. The cold drink occasions a genial glow upon the surface the moment it is swallowed, at the very instant, in fact, that the internal parts are chilled, which can be accounted for only by the rush of electricity through the skin.

Food, therefore, that supplies electricity in excess over magnetism to the human body (by whatever means it supplies it) must be heating food; and that which supplies magnetism in excess over electricity must similarly be cooling food; and as I have previously demonstrated that electricity in excess over magnetism tends to increase the solid contents of the body, and magnetism in excess over electricity to diminish them, so therefore electricity must excite the recrementitious vessels of the body to action, viz. the vessels *increasing* the solid contents thereof, and magnetism the excrementitious vessels or those *decreasing* the said solid contents; consequently the equilibrium of the bodily solid contents being kept up by the equilibrium maintained between these two classes of vessels, a preternatural action in the first must tend to an *increase* of these solid parts, and a preternatural action in the second to a *decrease* of them.

The recrementitious vessels, as I have previously exemplified, are characterised by the coloured tints of the fluids which they convey, and the excrementitious by the pale tint thereof; corresponding in fact, in opposition of colour, to the opposite nature of the bodies (viz. electricity or magnetism) chiefly abounding in them. Animal food being heating, therefore it must be an electric or recrementitious food; while acid fruits being cooling, they must consequently be excrementitious. Thus animal diet is of a constipating and fattening nature, while acid fruits are laxative and impoverishing; and hence the prevalence of excrementitious bowel complaints during fruit season: complaints, no doubt, of a sanative nature, in the first instance, tending to check the previous excessive recrementitious action engendered during the hot season, but which frequently end in a diseased or excessive excrementitious action of the intestinal excretories.

Digestion being simply a galvanic decomposition of the ingredients taken into the stomach, food will consequently be digestible, or, in other words, decomposable, in proportion to the weakness of its constituent affinities; and hence what are called indigestible substances are made more easily digestible by being kept until their constituent affinities are weakened by incipient putrefaction. Salt, sugar, alcohol, and the bitter principle, are all fattening substances, therefore their action must be electric or recrementitious; while vegetable acids are impoverishing substances, and consequently their action must be magnetic or excrementitious. Yet the above substances, whether electric or magnetic, are equally capable, in large quantities, of preserving from galvanic decomposition, or in fact of rendering indigestible every species of animal or vegetable matter to which it may be applied; while again small quantities of them render the above more decomposable or digestible than if none had been used at all: a circumstance well known to cooks, who frequently sprinkle with salt, or dip in vinegar, flesh and fish previous to being cooked, with a view of making them tender, a fact indeed which our own feelings convince us of by the necessity we are in of taking a moderate quantity of spirits, salt, sugar, or vinegar with what we eat, to render its digestion more easy. Too much of any of the above, we see, therefore, must impair digestion, and hence the injurious consequences of using any of them in excess. The greater portion of human food being (as I have previously remarked) constituted of nearly equal parts of oxygen and combustible matter, it may therefore be supposed to contain nearly equal proportions of electricity and magnetism in chemical union with its particles, so that it would seem to require a small excess of either the one or the other to facilitate its decomposition, and hence the utility of the electric and magnetic substances before spoken of. We see, indeed, modifications of the above electric and magnetic substances supplied by the internal viscera for the purposes of digestion; the gastric juice being an acid, and consequently a magnetic substance; while the bile is bitter, and the pancreatic juice sweet, showing these on the contrary to be electric. The food seems thus destined to undergo two species of galvanic processes before being resolved into nutritious chyle, that in the stomach being probably assimilated to what is called the acetous fermentation, from an acid or magnetic substance being the cause of it, and that in the small intestines to the spirituous fermentation from the cause of this being an electric substance. That the first process of digestion should be of a magnetic nature seems evidenced not only by the conclusion we may draw from the primary acid action upon food in the body, but from analogy by what we see take place in food out of the body, when left to the decomposing galvanic influences of the atmosphere. Thus both animal and vegetable matter becomes gradually putrescent when so exposed; the offensive odour which it exhales showing the magnetic action going on, from all excrementitious matter possessing an offensive odour, doubtless from the magnetic excess therein, as well as from electric inflammable substances, such as charcoal, quickly dispelling this odour, evidently by their electricity neutralising the magnetism of which the above odour is constituted.

Thus a healthy digestion, and consequently nutritious process, must depend as much on a due portion of acid or magnetic matter being secreted by the stomach, as on a due portion of bitter or electric matter being secreted by the liver. Hence, in post-mortem examinations of many diseases the bile is found to be insipid, and in some of the most malignant, such as cholera, altogether wanting. Bodily health must therefore be in a great measure dependent upon the capabilities of the above secretions to excite the requisite galvanic action in the food, from which the chyle is to be extracted, for the excrementitious and recrementitious purposes of the body. In youth, recrementitious action has the ascendancy over the excrementitious, because the bulk of the body must not only be sustained, but further increase made thereto. In manhood again, the health is best when they are equal to each other; corpulency ensuing from the ascendancy of the one, and emaciation from that of the other; while in old age the excrementitious action gradually gains ground until the body is wasted to feeble decrepitude, and life eventually extinguished. Were all this left solely to chance, the animal body would soon be destroyed by the alternate, powerful, electric, and magnetic actions to which it is subjected; but it is one of the most beautifully harmonious of nature's laws, that when electric action is carried to excess, the appetite's cravings are for magnetic food and drink, viz. fruits and acids; while when magnetic action is carried to excess, electric food and drink, viz. salted or peppered substances, are on the contrary craved for, so that the equilibrium of action in the system is not only thereby preserved, but the very cravings of the appetite made to designate the species of action that prevails. Thus, after a dinner party, if electric action is in excess, cooling fruits and drinks are craved for; but if magnetic action be in excess the craving is for salted or well peppered food, and stimulant beverage; the same holding good in youth, when the electric is the prevailing action, and in declining life when the magnetic is so: cooling fruits being more generally relished in the one and heating regimen in the other.

When the acid juice of the stomach is insufficient to complete the acid fermentation in the food before its passing into the intestines, the above acid fermentation will consequently go on in the latter, thereby giving a tendency to bowel and other excrementitious complaints. To insure bodily health therefore, food should not only be taken in moderation, but well masticated before being swallowed, so as to admit of a speedy and equable fermentation taking place throughout it. Vegetable acids in moderation are useful when the gastric action is deficient, and bitters when it is too abundant, the first assisting the deficiency of acid fermentation, and the second checking the excess of it, each, however, in excess counteracting the galvanic action of the gastric action, or, in other words, the digestive powers, by acting as preservatives (as before illustrated) to the food. Persons are found to require, generally speaking, food and drink in proportion to the mental or bodily labours to which they are exposed, which requiring an increased amount of electro-magnetism to carry them on, consequently require an increased demand of food and drink to supply that electro-magnetism to the mind and the body—the above law, though generally applicable, being subject of course to exceptions. Men, therefore, that think hard, or work hard, require a greater amount of food and drink to keep the body in health than the thoughtless or the lazy; the smaller the amount however of the above supplying the requisite electro-magnetism, the less injurious to the constitution on account of the excrementitious matter to be evacuated being less. It is thus that excess in eating is infinitely worse than excess in drinking, though both are sufficiently deleterious; the medium being of course the best when the body is never over excited by excess, or enervated by a deficiency of requisite stimulus.

It is curious indeed to contemplate the different effects of the excitement of wine upon a thoughtful and a thoughtless man—the electricity evolved being principally directed toward the head in the first, while in the second it is equally divided between the head and the feet, so that, though the thoughtful man may be striking out the most sublime conceptions, his legs may be unfit to support him; while the thoughtless, though walking with firm and steady step may not have an idea brooding in his head to break through the foggy atmosphere within. Pitt, Fox, and Sheridan delivered, it is said, some of the ablest speeches ever heard in the British senate, when they could with difficulty stand upright. Indeed a thinking man is, at all times, an unsteady walker, being liable to trip at every stone, or to be pitched off his perpendicular by even the slightest push, from having less electricity in his heels than his head; while the less thoughtful trips nimbly along, without a stumble, from having more electricity in the former than the latter.

That the greater portion of the food and drink made use of is serviceable only so far as it attracts electro-magnetism through the medium of the skin, for the supply of the mental and bodily wants, seems borne out by the diminutive dimensions of the thoracic duct, the sole channel through which the whole of the nourishment extracted from the food is conveyed into the blood; its small crow-quill size seems quite inadequate to convey above a tenth of the substance of the food and the drink, daily swallowed, into the circulation, showing consequently the small portion required for nutrition, in proportion to that for electro-magnetic purposes. Could any substance in smaller compass therefore be discovered capable of furnishing the requisite electro-magnetic supply, not only would better health be enjoyed, from diminishing thus the amount of the excrementitious mass to be expelled from the body, but a greater amount of population would be capable of being sustained in a given space, from the diminution thus made in the amount of food consumed. The Peruvian Indians, for this purpose, chew the leaves of the cocca shrub, with an alkaline cake made from the ashes of a tree, and by means of the juice swallowed from a few mouthfuls of this daily, are enabled to perform the most extraordinary labours, with scarcely more besides than the substance of a good English meal a week; enjoying at the same time a state of robust health not generally found among the solid food-eaters of Europe. Were some such substances as the above but generally made use of for furnishing the body with electro-magnetism, how many more extra millions might not the earth be made to maintain, with less risk of their numbers being thinned by the multitude of diseases to which the present diet gives rise. All the substances composing human diet remaining undecomposed when closely excluded from the atmosphere; hence it is evident that their decomposition, in the digestive organs, cannot be owing to causes within the latter, but to causes existing in the atmosphere, indirect though the communication may in this case be; for if the food previously attracted, the electro-magnetism decomposing it from the body, the latter must eventually replenish its loss from the atmosphere.

The idea of the sensation called heat being produced by the motions and not by the amounts of atomo-electricity and atomo-magnetism, seems strongly borne out by this sensation being often experienced when the mercury in the thermometer is contracting, and that of cold when it is expanding, showing that the decrease of heat, or increase of cold in the atmosphere, produced no decrease in the one case, or increase in the other, in the sensations which they respectively excite.

GROWTH AND DECAY.

On man being thrust naked from the womb, a new world is opened before him. That nutrition hitherto drawn from the mother's internal uterus, and *directly* introduced into his circulation, is now drawn from her external mamma, and *indirectly* introduced through the medium of his own digestive system; while his blood formerly purified by the lungs of the mother, is now purified by his own. The dark juicy softness of his hair rendering it a good electric conductor, thereby enables the recrementitious action hitherto going on to be maintained; while the increase of the excrementitious secretions, and the occasional vomitings induced when growth proceeds too fast, by checking the latter, thus tend to check the formations of imperfect structure in the body. When, however, this growth still progresses too rapidly, the intense electro-magnetic introduction by which it is sustained frequently blanches the hair of a pale colour, thereby moderating the intense electro-magnetic excess, and consequently the too rapid growth of the body; reverting usually, however, to its former colour toward the period of adult age, when the electro-magnetic introduction through it is diminished, from the body's growth being perfected.

As puberty approaches the generative parts become gradually covered with hair, and as soon as there is enough to transmit a sufficiency of electro-magnetism to excite the seminal and menstrual secretions, these secretions are poured forth and man enters into a new state, his beard now budding rapidly forth, and new passions and feelings taking possession of his breast, thereby effecting a complete revolution in his ideas, and consequently in his conduct.

The long continued electro-magnetic transmission, by rendering the hairs drier and harsher, consequently diminishes eventually the amount of electric transmission, while increasing that of the magnetic, until the two actions become eventually equalised, and thereby terminate the growth of man; the same transmission, however, by the gradual change thus effected in the hair, at length enabling the magnetic transmission to gain upon the electric, until the former so far prevails as to gradually blanch by its action the colour of the hair which conducts it. Excrementitious action would consequently now be more powerful than recrementitious, and the body thereby made to decrease in bulk, did not nature prompt to counteract this, by increasing the stomachic call for stimulating regimen, by which the body's bulk and activity is for a longer period preserved. In youth, cooling acid fruits are craved for, because the recrementitious process greatly exceed the excrementitious, and so rather requires restraint than encouragement; but as white hairs make their advances, nature prompts a gradual advance in the stimulating nature of man's regimen: the one cup that would have intoxicated before, being now no longer sufficient to keep up his animal spirits or his body's bulk, and consequently requiring the number to be increased for the due sustainment thereof.

As new hairs, however, continue to be blanched, and the old ones to be ejected by the excessive excrementitious action in them, the electric stimulants had recourse to are at last no longer able to contend against the overwhelming magnetic introduction, all the softer parts now progressively decreasing in electric activity, heat, and bulk, until the magnetic influence eventually so far exceeds the electric as to extinguish vascular action; when the soul or mind, the supreme director of all the electric energies of the brain, takes its flight to render its account to the Being who installed it.

That white hairs are the cause of old age, and not old age the cause of white hairs, is a theory, I conceive, fully borne out by the laws of electro-magnetic action, by a constancy of which it eventually pulls down the very parts it built up, if no counteracting influence places it in check. In identifying electro-magnetism with life, and the mind with the soul, I have differed as respects the latter point from the impression somewhat generally entertained, founded upon the deduction, that as the mental functions are so often imperfect, the soul, being a perfect body, could not consequently be identified with the mind. Conceiving, however, the soul to be the supreme director of all the functions, both corporeal and mental, and that the human form is but a piece of animated mechanism, if any portion of the latter should be rendered imperfect through casualty during its construction, it would be as unjust to blame the Director of it for not producing perfect results, as it would be to blame the director of a piece of man's handicraft mechanism, for not producing perfect work, when any portion of the above was imperfectly constructed at the outset, or impaired in after times.

DISEASES.

THERE being only two distinct primary classes of vessels in the human body, viz. the recrementitious vessels secreting the solid parts thereof, and the excrementitious the fluid; so when increased galvanic action exists in either of them, that in the first must tend to increase the solid at the expense of the fluid parts, and that in the second to increase the fluid parts at the expense of the solid.

It is found, indeed, in chemical experiments, that two distinct species of action cannot go on in the same body at the same instant; a law which, as far as present experience extends, applies also to the human body, the general theory of the cure of whose diseases has been that of translating the diseased action from one class of vessels, or from one part to another, as the galvanic disease, as it may be termed, in copper, is translated to the iron in the Davyan preservers. From what has been said above, therefore, when increased galvanic action exists in one class of vessels, it must naturally decrease the action in the other class; so that by giving remedies to increase the action in the vessels where there is diminished action, you will diminish the action in the vessels where there is increased action; and by thus bringing the actions of the two classes of vessels to an equilibrium, you consequently cure the increased, or, in other words, diseased action, which exists in either.

Diseases being thus either recrementitious or excrementitious, the remedies employed to cure them may be divided into recrementitious and excrementitious, according to the class of vessels whose action they are capable of increasing. The recrementitious or fattening remedies are the black oxide of mercury, sugar, common salt, bitters, charcoal, the various non-purgative salts, and, in fact, the whole of the remedies known by the name of stimulants; all such, indeed, whose chemical analysis shows them to contain comparatively small proportions of oxygen in their composition: while the excrementitious or impoverishing remedies are the acids, and the various substances called narcotics, or sedatives, whose analysis shows them to contain comparatively large proportions of oxygen in their composition. Although there are different classes of solids, yet no remedies having been hitherto noticed, acting upon any one particular class without affecting the whole, therefore recrementitious remedies may be designated as such whose general tendency is to increase every species of solid in the body; while, on the contrary, different classes of medicines being found to act almost exclusively upon one particular class of fluid secretors, without affecting the others, consequently we have the appellations of purgatives, diuretics, sudorifics, and ptyalists, according as they respectively increase the action of the excrementitious vessels of the bowels, the kidneys, the skin, or the salivary glands. As we are thus ignorant of any medicines capable of curing increased action in one class of recrementitious vessels by exciting increased action in another class thereof, or, in medical language, of translating the disease thereto, we must consequently translate the disease to the excrementitious vessels, in order to effect a cure. As, however, we have remedies capable of increasing the action in one class of excrementitious vessels without affecting the others, so we are thereby enabled to cure excrementitious disease in one class by translating it to another class thereof, where it would be more under the power of medicine. This latter system of treatment can, however, by no means be depended on, because the above remedies do not uniformly act upon the class of excrementitious vessels, which their titles designate them to do, but frequently upon other classes of these vessels; reputed purgatives often operating as sudorifics, and sudorifics as diuretics and ptyalists. Therefore, as a general rule, it will be as advisable to apply recrementitious treatment to excrementitious diseases, as excrementitious treatment to recrementitious diseases.

Recrementitious and excrementitious affections oftener occur as sequences of each other, than as isolated diseases; and hence, by curing or preventing the attack of the primary of the two, the attacks of the secondary are prevented also. Thus in intermittent, we have first excrementitious action indicated by paleness, shivering, and shrinking of the body, and increase of the urinary discharge; to this succeeds recrementitious action, indicated by great heat, thirst, and fulness of pulse; and lastly, excrementitious action winds up the paroxysm, indicated by the profuse perspiration in which the body is drenched. Now, by preventing the attack of the first stage of the paroxysm, that of the others is prevented also, which is effected by the administration of recrementitious remedies in the intervals of the paroxysms, such as the quinine, brandy, port-wine, &c. &c. Again, in scurvy, which has a recrementitious commencement, by administering excrementitious remedies, such as vegetable acids, &c., we not only cure the primary recrementitious disease, but the various excrementitious ones succeeding to it,—diarrhœas, ulcers, ptyalisms, and the like. I have previously shown that both electric and magnetic, i. e. recrementitious and excrementitious substances, applied in large amount to decomposable bodies, preserved them from destruction, by counteracting the galvanic action to which they were in an isolated state exposed; and that when, on the contrary, applied in small amount to bodies, they tended to produce more rapid decomposition of them than if the said bodies had been left in an isolated state.

The same law also holds good with a number of the medicines prescribed, whether these medicines be recrementitious or excrementitious, large doses of them seeming often to allay active galvanic action, while small ones tend to increase it. Thus, calomel in large doses soothes and constipates, while in small doses it purges and gripes; the former thereby giving great relief in dysentery, while the latter usually increases the disorder, until the recrementitious action upon the body begins to be evinced by the tenderness and swelling of the gums. Quinine too, in small doses, is generally rather prejudicial than otherwise in intermittent, while in large doses it effects a rapid cure. The same remark applies to opium, which in small doses commonly excites restlessness instead of conducing to sleep; small doses of it in acute dysentery being also either useless or hurtful, while large doses tend to the most happy results. Opium too, exhibited in large doses, before the cold stage of intermittent, either greatly alleviates, or altogether prevents the same: a very pointed case of an excrementitious substance given in excess checking or altogether preventing excrementitious action. The same cessation of galvanic action in bodies therefore ensuing, whether electric-attracting or magnetic-attracting substances be applied in excess to them, we may consequently presume that either electricity or magnetism, applied in excess, would produce a similar cessation of galvanic action; which certainly is the case with respect to magnetism, from the fact of frozen bodies suffering no decomposition, and is in some measure the case with electricity also, from cooked substances keeping longer than uncooked. The latter, however, are not fair criterions of electric and magnetic influence applied to the protection of bodies from decomposition, in consequence of the water constituting their juices being mainly composed of the magnetic-attractive substance, oxygen, through which this water would assist the magnetism as much in its protective influence, as it furthered the decomposing influence of the electricity; and I doubt not, were the electric or magnetic wire applied singly to the above bodies, their influence would be found as protective against decomposition as the influence of salt, acids, or any other electric or magnetic substance previously treated of.

In accordance also with these views, a combination of recrementitious and excrementitious remedies in the same disease must be either uncertain, or absolutely prejudicial; so that in recrementitious disease, excrementitious remedies should be solely employed; and in excrementitious disease, recrementitious remedies solely; the regimen being at the same time made conformable to the medicines, otherwise the one will necessarily counteract the other. In pursuing this course, however, care should be taken to suspend the exhibition of the remedies the moment the action aimed at is induced, lest a disease of a different nature to the one under treatment should result, from pushing the above remedies too far. Thus in prescribing mercury as a recrementitious medicine, the moment tenderness and swelling of the gums and salivary glands appear, its further use should be stopped; because if recrementitious action in the above parts be further pushed, an excrementitious salivary disease in them will be the result, from which no good *can* arise, and much evil *may*, in consequence of the ready translation of diseased action from one part to another, as evinced particularly in the recrementitious diseases, rheumatism and gout, and in the excrementitious actions consequent on phthisis, where the excretories of the bowels, the skin, the lungs, and the urinary organs, are all in turn affected. I have before illustrated the impossibility of both recrementitious and excrementitious diseases subsisting, as general diseases, in the system at the same instant; but this does not hold good as far as local diseases are concerned: a local excrementitious disease being often found accompanying a general recrementitious one, and *vice versa;* so that in some cases a difficulty may arise as to the nature of the general action subsisting, in order that the treatment may be adapted thereto. I have found the relish, or disrelish of vegetable acids, to be the best test of the species of general disease; a relish of them showing it to be recrementitious, and a disrelish excrementitious; a relish or disrelish of sweet, salted, high-seasoned articles, or of spirits, similarly also exemplifying the species of disease. While one species of treatment therefore is applied to the general disease, another, or opposite species, is demanded by the local one. Thus the recrementitious disease, scrofula, often causes the tumours consequent on its action to terminate in excrementitious suppuration and ulceration, to which we find it best to apply stimulant or recrementitious remedies; while sedative or excrementitious suit best the general disease: a long course of saline purgatives, with solutions of sulphate of zinc, lime-water, &c. to the sores, seldom failing of greatly relieving, if not curing the complaint.

All general diseases, indeed, commonly commence in local galvanic action, that action only becoming general, when important or extensive parts of the body are affected; the local pain necessarily pointing out the part where the electro-magnetism feeding the disease enters, being the part where the nerves conducting that electro-magnetism to the seat of disease terminate upon the skin; and here, therefore, the local remedies must be applied. In disease of the liver, therefore, I would blister or cauterise the part of the shoulder where pain usually occurs in this complaint, and the same with the knee in disease of the hip joint. Atomo-electricity, or heat, when locally applied, never fails of giving relief in local pains, its action being upon the principle already expounded of electricity in excess, or magnetism in excess, putting a stop to galvanic action. The relief it affords is, in fact, similar to that produced by large doses of calomel in dysentery, expanding the parts in a state of spasm, by the electricity which it directly infuses into them; while the calomel indirectly accomplishes this, by attracting the electricity from the atmosphere through the medium of those pained parts. Heat, however, is but of little comparative service, and indeed is frequently prejudicial, unless the temperature at which it is first applied be kept unremittingly up, until the disease is subdued; so as to insure electricity being always in sufficient amount in the part to counteract the diseased action under which it labours. This point is insured by the use of the stomach pan enveloped in flannel, the water of which can be readily changed on becoming too cold, and a constant uniformity of high temperature thereby kept up in the part. In all painful bowel complaints it acts like a charm, and I have found it equally successful in lumbago, and indeed in every local pain; while applied in several cases over poultices, its action has been similarly beneficial, obviating at the same time the trouble of their frequent renewal.

Cold applications have been also found highly useful in local diseases, as well as in fever, peritonitis, and other diseases of a more general nature; but I have always observed, unless their temperature was kept as uniformly low as that of hot applications was kept uniformly high, that the cure of the above was little advanced, if not absolutely retarded by them.

In considering salt and charcoal as powerful recrementitious remedies, I am amply borne out as to the former, not only by the universal experience of those engaged in the grazing of animals, where it is employed as a means of retaining them in health, but of the fatteners of them for slaughter, who so well understand the utility of it in that respect, as to have originated a proverb among many of them, that for every pound of salt you give an animal you have a pound of fat in return. This applies well to its use on shore, where excrementitious remedies are always at command to check its pushing of recrementitious action so far as to induce excrementitious disease; but on board ship it must necessarily be used more sparingly on the above account. Charcoal, although not hitherto given to animals with the above view, will, I doubt not, be found equally beneficial, from the natural predilection that many animals show for it, when they have an opportunity of indulging therein. Pigs are particularly fond of it, and in New South Wales seldom fail in paying daily visits to the places where timber has been burnt off, for the purpose of satisfying their longings. I was indeed assured, by a friend of mine, an old and highly respected merchant captain, that he knew an instance of a pig being stowed away, by accident, for a considerable period in a coal hole, which was brought on deck, plump and fat, after discovery, although it had nothing but coals to subsist upon!

Charcoal and coal being both inflammable bodies, and both, I believe, good electric conductors besides, hence they must be recrementitious when judiciously administered to animals that relish them; because the liking or disliking of the palate are, generally speaking, the surest guides to go by, as to the beneficial or hurtful effects of articles of food. Similar views, indeed, apply to vegetable growth, the burning of soil in moderation increasing its fertility by imbuing it with a sufficiency of electricity to promote vegetable health, without proceeding so far in the burning as to injure vegetable life by the too great electric amount infused into the soil. Salt, lime, and ashes, in moderate quantities, are as salutary also in the above respect, as they are pernicious when an over-dose is applied. The forcing beds of gardeners are made of a dark colour, with a view only of attracting heat, but whatever attracts heat must be an electric remedy; and hence may, like salt and charcoal given to animals, exert an independent effect of its own upon plants, either from its absorption by them in an undecomposed state, or from its decomposition by their digestive organs. Hence, I conceive, charcoal-dust, and the dust of coal, would be highly fertilising applications to what are called poor soils, particularly those of white tenacious clay, on account of their not only imbuing them with a highly electric or recrementitious substance, but enabling them to absorb heat as well as to admit of a freer entrance of air and moisture, by the darkening of their colour and the diminution of their cohesive qualities. Seeing the immense variety in the nature of the diet of different nations, we are naturally impressed with the belief that human sustenance is almost illimitable, *habit* making that species of food delectable and wholesome to one, which is disgusting or even pernicious to another. In Peru, the natives make an agreeable meal of the chewings of the cocca leaves and wood-ashes; in others, cakes of saw-dust mixed with meal are equally relished; while, in our own country, what numerous articles do we not use, disagreeable at the outset, but for which habit at last gives us a taste. In this word taste, indeed, lies the whole of the mystery, because the palate seldom relishes that which proves pernicious to the body; the complaint of articles much relished so often disagreeing, being readily traced, in most instances, to the person's too great indulgence in them, on account of the very relish above spoken of inciting to their immoderate use. Saw-dust has been converted, by a very simple process, into the highly nutritious article of sugar, and hence, may not the stomachic juices be equally able to extract nutrition from saw-dust, when accustomed thereto? Nay, may we not presume that as the advance of population drives the wit of man to its shifts for the sustaining thereof, that the science of chemistry may be able to convert many articles now thrown aside as refuse, into wholesome food; if the advance of the chemical science of cookery be not able to effect this, by means of the ingredients combined with it previous to submission to the electro-magnetic influence of the fire?

EPIDEMIA AND CONTAGION.

Seeing that oxygen and its active compounds, the acids, destroy epidemic miasma and contagion, we may consequently infer that their active properties depend upon magnetism. This is further corroborated by excess of epidemic miasma equally preserving the body from galvanic disease that excess of magnetism has been shown to do with dead matter, a fact all who have been in sickly countries must have noticed: ships being generally more unhealthy immediately after leaving a sickly port than when in it; the disease, indeed, frequently not breaking out until the vessel has been some days at sea. When detained three months on board a ship at Batavia, during the sickly season there, the shipping was not only more unhealthy than the town, but almost every person hired to work on board ship from the shore was seized with the prevalent fever, a few days after he had joined. Although we had only two men on the sick-list when weighing anchor, before we were four days at sea a quarter of the ship's company, and myself amongst the number, were added to it.

Acid vapours destroy all kinds of bad odours; and hence also, these must, I conceive, derive their active principle from magnetism, thereby accounting for their power of neutralising contagious influence by the intense magnetic medium with which they surround the body. It has been also remarked that tallow-chandlers, oilmen, and all such as work much among strongly odoriferous matter, are but little subject to contagious or epidemic diseases, while experience has instilled into mankind the belief that camphor and other strong-scented substances worn about the body preserve it from contagious influence, some of them probably deriving this power from containing electricity in excess, and others from containing magnetism in excess; either of which, in sufficient amount, would tend, as before shown, to moderate galvanic action. Fumes of tar, camphor, and tobacco have all been successfully used as anti-contagious fumigations, and indeed I mainly attribute my freedom from fever at Batavia to cigar-smoking, and my attack of it at sea to leaving the smoking suddenly off. A strong exemplification of the above view is afforded by garlic and similar strong odoriferous substances rubbed about the mouth and nose, not only preserving both men and animals from the attacks of the paralysing complaint denominated sorochi, to which they are exposed in travelling over the South American mountains, but also checking its further advances, when timeously made use of.

When we contemplate, however, the different coloured and constituted parts of the human body, we may infer, that as each different part contains different proportions of oxygen and combustible matter, so each part will consequently attract different atomic proportions of electricity and magnetism for the furthering of its growth, the retaining of it in health, or the feeding of the disease which brings on its decay; so the above magnetic or electric odours, by changing the atomic proportions of the pestiferous miasma, would destroy the power of exciting disease in the parts of the body to which their former constituency adapted them. We have an illustration of the above view of various proportioned electro-magnetic atoms being required in the human body, by what we see exemplified in vegetable substances, each different vegetable requiring a different-coloured earth to thrive in, showing that each required differently constituted sun's rays to keep it in health. Some of the ingenious New England men have indeed gone so far, as in some measure to obviate this necessity of particular coloured soils, by painting the stems of their different fruit-trees of a tint which experience has taught them to be most conducive to the perfection of the various fruits. That contagion and epidemic miasmata have magnetism in excess in their constitution, is evidenced by the attacks of contagious and epidemic diseases invariably commencing with depression of strength, sleepiness, and chilliness, as well as in unhealthy vapours exciting these very sensations. A medical gentleman of Arequipa informed me that while riding early in the morning through a dense vapour through the unhealthy valley of Vitor (Peru), the sense of cold and drowsiness was such as almost to incapacitate him from retaining his seat, it being only through constant quaffing of port wine that he was enabled to do so, finishing a bottle easily without being intoxicated thereby, although on other occasions a few glasses were more than his constitution could stand. The constant westerly tendency of the various malignant diseases that have desolated the world, is a further collateral proof of the electro-magnetic composition of the malaria which cause them, being obviously moved westerly by the same sol-lunar influence moving the waters of the ocean in a westerly direction, thereby giving rise to the tides. Their rapid descent of rivers through the attraction of the current, and their rapid passage along highways and other places, where the winds attracting them have least obstruction, similarly tend to confirm the deduction above drawn.

After an epidemic disease, however, has once commenced, an accumulation of the particularly constituted electro-magnetic particles, to which it owes its existence, will naturally take place round the patient, not only by attraction of them from the atmosphere, but by emission of them from the body after having performed their baneful functions there, so that by an accumulation also of patients, the electro-magnetic particles will become, at last, so intense, as to be capable of exciting the same disease in persons exposed to their influence, or, in other words, the disease will become contagious. Hence, many epidemic and endemic diseases at last assume a contagious form when the patients are crowded, or proper ventilation and cleanliness not attended to. As these electro-magnetic particles may be attracted by bodies which have not the power to decompose them, they may in this way be transported in merchandise from place to place, and thereby spread the disease. Hence, therefore, the quarantine regulations seem founded in reason; but as the sooner this contagion is destroyed, and the merchandise distributed, the less is the chance of its spreading, and the greater is the benefit conferred upon commerce, consequently the vessels cannot be unloaded, and their cargoes purified and disposed of, too quickly. For this purpose two large floating hulks should be anchored in places to which the winds have free access; their middle decks, set apart for the cargoes, being constructed of open grated work, to admit readily the vapours and wind currents by which the cargoes were to be purified, and with jutting frame-works projecting out in a fan-shape from the stern and bows, and numerous ports all around, their construction would be complete.

When the cargo was arranged in the middle decks, the ports should now be shut close, and the fumigating vapours made to ascend upwards through it from the deck below, after a few hours of which exposure the ship might be hauled head or stern to wind, the ports opened, and the breeze allowed to blow freely through, until a thorough purification was effected. As the detention in quarantine of such cargoes as are incapable of decomposing the contagious miasma can do no good, therefore the exposure of all such to the purifying process is the only way of avoiding contagious introduction; but as all strongly odoriferous substances, such as spices, oils, &c. will accomplish their own purification, hence they require no quarantine restrictions to effect this point, and by indeed mingling camphor, spirits of turpentine, or other odoriferous matters with merchandise, such as cotton, incapable of self-purification, the whole of the vexatious quarantine regulations might, I conceive, be safely dispensed with.

Persons employed, however, in quarantine hulks, should guard against contagion by cleanliness, rubbing of their bodies daily with camphorated oil, and wearing of wire masks over their face when exposed to its influence. The lungs being more susceptible than the skin, as well as being more central as respects the body, and more near the vital parts; hence it is probable that infection generally enters the body through this channel, and therefore the avenues to the lungs cannot be too strictly guarded. The wire mask would, I conceive, effect this purpose, on the same principle that it prevents offensive odours from suffocating the person exposed to them, and flame from setting inflammable vapours in combustion when an insulating wire frame surrounds it. The whole superficies of the wire being surrounded with a covering of mass-electro-magnetism, hence when the openings were sufficiently *small,* no particles of matter, possessing a large proportion of either magnetism or electricity could pass through the crevices, from being attracted or repelled either by the magnetic or the electric mass enveloping the wires.

The Davy lamp will, I conceive, answer the purpose for which it was intended no longer than the wires remain free from incandescence, because the moment this is attained they will naturally ignite the combustible gases in their vicinity. As an incandescent wire is found to ignite every highly inflammable substance exposed to it, the incandescent wires of the lamp must be capable of doing the same, the fallacy in the lamp being a preservative against explosions, probably arising from the greater portion of the combustible gases in the trial jars being decomposed *before* the lamp wire became red hot.

HEMISPHERIC INFLUENCE ON DISEASE.

The northern hemisphere attracting magnetism toward the earth, and the southern repelling it therefrom, will consequently cause it to be more intense near the earth in the north, and less intense near the earth, and therefore more equally diffused through the atmosphere, in the south; which diversity of magnetic attraction will consequently tend to make excrementitious diseases less common, though more virulent, in the northern hemisphere than in the southern. Electricity again being repelled from the earth in the northern hemisphere, and attracted thereto in the southern, will tend to make recrementitious diseases, on the contrary, less common though more virulent in the southern hemisphere than the northern.

The above hemispheric attractions and repulsions will also tend to make the upper parts of the body more liable to recrementitious diseases than the lower parts thereof in the northern hemisphere, and consequently *vice versa* in the southern; while the reverse will necessarily apply to excrementitious diseases, the upper parts of the body being most liable to their attacks in the south, and the lower parts thereof most liable in the north. Besides the respective electric and magnetic tendencies toward the upper and the lower parts of the body, through the medium of the nerves and the blood-vessels, the opposite polarities of the human body in the two hemispheres, must also have great influence upon diseases affecting respectively the upper or lower parts thereof. Thus in the northern hemisphere, mass-electricity occupies the superficies of the upper part of the body, and mass-magnetism the lower; while in the southern hemisphere mass-magnetism occupies the former, and mass-electricity the latter; a reverse of polarity which must doubtless influence greatly the diseases of the above parts. In the southern hemisphere excrementitious diseases, such as dysentery, diarrhœa, bronchial consumption, and dropsical affections, are more common, though less virulent than in the northern hemisphere; while, on the contrary, the recrementitious diseases, scrofula, and tuberculous consumption, so common in England, are there scarcely known. Throughout the whole continent of New Holland, yet settled by Europeans, intermittents and remittents are so rare as never to excite alarm even in the most marshy places, and also so mild as to yield readily to medicine.

Though more common throughout the Brazils, yet there also they are mild and tractable, being common however in the irrigated valleys of Peru, on account of the greater vegetable decomposition, and bad ventilation; from the south-easterly winds, so constantly prevailing in Peru, blowing across instead of along them. Mania, evidently a recrementitious or electric disease, is equally rare, I might almost say nearly unknown, among the natives of the southern hemisphere, where I have made inquiries; the recrementitious diseases having a greater tendency here towards the lower extremities, and hence the prevalence of elephantiasis in southern climates; while in the cases of scurvy there, I have observed that while the feet and legs were intensely tumefied and bloated, the gums were comparatively but little affected. In every part of the northern hemisphere intermittents and remittents are severe in their attacks, while it is only in certain parts of the southern hemisphere, near the equator, that the above diseases show a virulent type, which I conceive may arise from the annual shifting of the equatorial neutral line by the sun's influence, through which the northern electric zone is made to approximate annually upon the southern hemisphere, and the southern magnetic zone upon the northern hemisphere. To this also may be owing the frequency of elephantiasis at Barbadoes, and other places in the northern hemisphere near to the equator. From the above views, therefore, a change of hemispheres in various untractable diseases might be attended with the most salutary effects, transposing for instance scrofulous, maniacal, and tuberculous consumptive cases to the south, and bronchial consumptive and other excrementitious diseases to the north. In fact I never heard of a case of scrofulous consumption removed to New South Wales, sufficiently early, where a cure was not effected. In scrofulous families indeed, a removal of children to the south for education would, I am confident, be attended with the most beneficial effects upon their future health, by freeing their constitution from a disease as untractable as loathsome, and which when attacking the lungs consigns thousands yearly to an early grave.

Nor would the similar removal of the southern children to the north be unproductive of useful results, conferring as it would upon them more animation and intellectual vigour, though at the risk of impairing their prudence and judgment, and of imbuing their constitutions with the seeds of some of the fatal diseases to which the northern hemisphere is exposed.

From the necessarily more equable diffusion through the southern atmosphere of all magnetic bodies capable of such diffusion by the hemispheric repulsion, I conceive therefore that should the plague, cholera, and other excrementitious diseases ever be introduced into the southern hemisphere, they will be infinitely milder than in the northern, though attacking probably a larger portion of the population.

As electricity and magnetism have been shown to be attracted by particular substances, and repelled by others, hence on this account the varied composition, as well as colour, of the earth's strata may vary the density, and consequently the attraction and repulsion of the electric or the magnetic mass enveloping their superficies, and thereby vary the nature of the hemispheric locality as to the effects produced by it upon the human constitution. Such a local increase or decrease in the depth of the zone, would, according to the increase or decrease effected by it in the amount of electricity or magnetism in the atmosphere, affect the human constitution, independent of differences of atmospheric density, or atmospheric vapour, which have been the only causes hitherto assigned for the beneficial or baneful effects which change of locality are observed to produce in diseases. The changes, in the nature of the daily food, which the human appetite craves for, show that such changes are requisite for the healthy fulfilment of the bodily functions; and may we not similarly conclude with respect to the lungs, that occasional changes in their food are also highly conducive toward the attainment of the above point.

MOON'S INFLUENCE ON DISEASE.

THAT the magnetic rays radiated from the sun to the moon, are more intensely reflected or radiated by the latter to the earth, than the electric rays, is evidenced by the moon's rays being not only destitute of heat, but by their producing similar effects in the bodies upon which they impinge to the magnetic or deoxidising rays of the sun. Thus the moon's rays, by their oxygenous attraction, ripen fruit and grain, promote animal and vegetable decomposition, tarnish colours, and extinguish combustion equally with the sun's deoxidising rays; these effects, however, being more strongly manifested in the more tropical latitudes, where their rays are necessarily more powerfully showered down by the moon, and in the lesser clouded countries, where there is less impediment to their descent. Ships' stewards are so well aware of this that they will sooner expose meat and vegetables to the sun's rays in these countries than to the moon's: the former, by their electric action, drying up and hardening the exterior of the meat, and thus forming a protecting crust around it, similar to the protecting tin cases in which meats are now preserved; while the latter being incapable of forming such a crust, the meat is consequently left exposed in its moist state to the deoxidising influence of the rays—moisture being, in a great measure, indispensable to both animal and vegetable decomposition.

It is to the formation of this protecting crust that we may partly ascribe the preservative influence of the pyroligneous acid, when applied to the exterior of meat; and it is to the reabsorption in the dark, of that oxygen extricated by the light, upon which the colours of bodies depend, that we may ascribe the curious fact of our tarnished coats appearing nearly "as good as new" after being deposited for some weeks in the lumber chest. Seeing, therefore, the powerful influence of the moon's rays in the decomposing of bodies, we may readily account for the greater prevalence of particular diseases during full moon (as remarked by the olden physicians), from the sun and moon's magnetic rays acting then *simultaneously* together, and consequently causing a greater vegetable putrefaction. The curious fact vouched for by Ulloa, of the hollow stem of a species of reed at Guayaquil, always filling with water at new moon, and ebbing therefrom as she waned, might tend to the belief that she would exert a similar attraction upon the blood, and hence excite diseases of the cerebral functions. Many lunatics are certainly worse at particular periods of the moon; but this is more likely owing to the influence of her rays than of her attractions. Nearly all the patients who applied to me for relief in Peru, more particularly the rheumatic ones, complained of an aggravation of symptoms during full moon.

The cause of the sun's electric rays not being radiated to the earth by the moon equally with his magnetic rays, may be owing to the lesser velocity of the latter enabling them to be more easily attracted by the earth, as, in a similar way, the lesser velocity of cometary bodies, when distant from the sun, seems the only apparent cause why the distant planets attract more moons round them than the near. This lesser velocity of the magnetic rays than of the electric seems probable from their easier atmospheric refraction; while the sun, which thus contains the power of more strongly repelling these electric rays, by which their greater velocity is acquired, may be also presumed to contain a power equally strong of attracting them back again after performing their various important functions in the universe; so that the electric rays radiating from the moon, by being more strongly attracted back by the sun than the magnetic rays, would be less liable to be attracted by other planetary bodies than the latter, and consequently have their influence less felt throughout them.

The manner in which I conceive the electric and magnetic atoms are repelled from and attracted back by the sun, I have endeavoured to explain in the chapter in the preceding essay relative to the latter. But if such a power be possessed by the sun of attracting back the electric atoms more strongly than the magnetic, this power must necessarily centre in his magnetic zone, and therefore it may be presumed that his electric zone will possess an equally strong power of attracting back the magnetic atoms; so that both being thus attracted back with equal power to the sun, it might be inferred that no increase of cold would take place in consequence of the sun's setting, seeing that magnetism, the principle of cold, was attracted back to him equally with electricity, the principle of heat. If however the greater refrangibility of the magnetic rays than of the electric be ascribable to their slower motion, this latter must be owing to their less powerful expulsion from the sun's magnetic hemisphere, thereby evincing that the repulsion of magnetic atoms for each other is less powerful than that of electric atoms for each other; so that while the majority of the latter will be propelled thereby into the higher regions of the atmosphere, and thus brought within the sphere of the sun's horizontal attraction, even after his setting, the majority of the former will, by reason of their lesser repulsion for each other, be retained nearer the earth, and consequently out of reach of the sun's horizontal attraction, until he rises again in the east. The weaker repulsion of the magnetic than of the electric atoms for each other seems borne out therefore by their easier atmospheric refrangibility, as well as by their remaining near the earth's surface, after the majority of the electric atoms have vanished therefrom; for as heat and light always move in straight lines, except when a resisting medium interposes, so the sun would naturally have more power in attracting the electric than the magnetic atoms, when he was below the horizon, in consequence of their higher ascension in the atmosphere bringing them within the sphere of his horizontal attraction, and thereby enabling them to radiate in *straight* lines toward him. To the above may be ascribed the sudden fall of temperature so often experienced toward day-dawn; while the increase of brittleness and diminution in volume of bodies exposed to extreme cold, serve as further collateral proofs of the weaker attractions as well as repulsions of the magnetic atoms in comparison to the electric; because if their repulsive powers be weak, their attractive powers will naturally correspond thereto.

REMEDIES IN DISEASE.

ROTATION.

THE operation of rotation, so successfully employed by Dr. Cox, in the treatment of mania, I should set down as the most powerful of all general remedies, in the treatment of galvanic disease. It counteracts the central attraction of the electro-magnetism of the body by its centrifugal influence, thereby throwing it toward the surface, and even eventually from the body, in proportion to the rapidity of the rotation, and consequently preventing its too powerful operation on the internal parts. It is no doubt through the influence of this rotation, that the electro-magnetism is made to form zones encircling the superficies of the earth, a rotation which is seen, in the experiments upon bodies in the class room, to eventually eject the above from their superficies in shape of sparks. While rapid rotation thus checks diseased action, a milder application must tend to equalise the electro-magnetism throughout the body, and thereby keep it in health. Swinging, cradle-rocking, and horse-back exercise, no doubt act beneficially in a similar way, but rotation must be infinitely more powerful than any of them; so powerful indeed, that I have no doubt even death might be occasioned by carrying it on too rapidly and too long.

Sleep is always found to result from a moderate use of it, and vomiting and fainting, when carried to a greater extent; an extent, however, which, in acute diseases, it may be often necessary to proceed to. We see a natural instinct in man to resort to this powerful remedy for relief, in his rolling about when in acute pain, and instinctively turning in bed, when restless and uneasy, for the attaining of ease and sleep; by this not only equalising the body's electro-magnetism, but changing also the poles thereof. Even animals seem well acquainted with its useful effects, always rolling themselves after their day's work, as well as when disease attacks internal parts, particularly in inflammation of the bowels and colic.

BLEEDING.

This is always found to be most effective when carried to vomiting and fainting, by which its primary effects seem assimilated to rotation, from evidently causing the above effects through sudden electro-magnetic subtraction. When bleeding, however, is resorted to in small and repeated quantities, a stimulant effect is the result; a white dry tongue, quick pulse, thirst, flushed face, and all the other usual febrile symptoms ensuing, when this practice is adopted.

Dr. Watts's treatment of diabetes is an exemplification of this; similar ones to which I have witnessed in other diseases subjected to repeated bleedings, and the same must have occurred to every medical man during his practice. This general febrile excitement may be accounted for, by the gradually thinner state of the blood admitting the electro-magnetism to act more and more readily upon it, in the same way as we find the more fluid kinds of food to be more readily acted on in the stomach, or digested, than the more solid. It is, indeed, a common custom with farriers to take small bleedings from poor horses, for the purpose of bringing them into good condition, these acting as most useful alteratives when excrementitious disease prevails.

ABLUTIONS AND FRICTIONS.

When we contemplate the important offices performed by the skin, of its not only being the medium of transmission of all the electro-magnetism to and from the body, required in the performance of the various functions, but the outlet for one of the principal bodily excrementitious secretions—viz. the perspiration;—the necessity, therefore, of keeping this important communicating medium in a state of health is sufficiently obvious. Spongings with water, and frictions with a hard towel, have been, in fact, found to render the most important services to the general health, by every individual who has put this plan in practice, increasing the hilarity of the spirits, giving a comfortable feel to the body, promoting the appetite, and steeling the system against the influence of the various diseases which may be prevalent at the time.

INSULATION AND CAUSTICS.

As electro-magnetism, the food of all diseases, passes to these through the pores of the skin, hence the covering of this with a non-conductor, or the conversion of the skin itself into a non-conductor, must have a powerful influence over disease, by cutting off its electro-magnetic supply. Flannel, cotton and silk padding, flour, various of the metallic oxides, and resin-plasters,— all non-conductors, must owe their beneficial effects principally to this virtue in them; while the mere dyeing of the skin of a dark colour will necessarily exercise a similar influence, by cutting off the supply of *one*, at least, of the above active bodies, which is no more, probably, than what the greater portion of the others perform. This dyeing of the skin I have hitherto effected by a solution of nitrate of silver, and have witnessed from it the most beneficial effects in arresting the progress of incipient tumours; but I doubt not the same good would result from a coating of paint, of which colours I conceive white to be the best, from its repelling the electricity and attracting the magnetism, by which excrementitious action (the action desired) will be excited, and the recrementitious action consequently arrested. Blisters perform a double office; not only translating the internal galvanic disease to the surface, but, by their oxidating effects upon the skin, preventing the further ingress of electro-magnetism to the disease.

Of all the blisters, nitrate of silver is decidedly the best, because its action commences the moment it is applied, while the action of the common blister does not take place for several hours, during which time the disease within may have made rapid progress toward an unfavourable crisis. I never witnessed the slightest bad symptom produced, even by the most extensive application of this very active remedy, having been obliged once to cauterise the whole of the abdomen in the course of a few days, to arrest the progress of a violent attack of peritonitis, which continued obstinately spreading beyond the verge of the first partial applications. Whatever insulating coverings are made use of, should embrace the surface closely, so as to prevent the atmospheric air from circulating between them and the skin, otherwise but little comparative benefit will be derived from their application.

SEDATIVES AND NARCOTICS.

DURING sleep there is a cessation of all the voluntary actions, and a diminution even of the involuntary, as evinced by the slower state of pulse and respiration than when awake. As all the above, therefore, are dependent upon galvanic action, whatever diminishes the activity of the latter, must necessarily conduce to sleep; and, as I have previously exemplified that electricity in excess, or magnetism in excess, decrease this activity, and in large amount even cause a total cessation of it, so therefore both electricity in excess, and magnetism in excess, must tend to produce sleep, and even, at last, death itself, when in too great quantity.

This reasoning seems borne out by the effects of electricity or magnetism in excess, upon the human body: great heat or great cold, a large dose of spirits, or a large dose of opium, all exerting a soporific power upon the constitution. The soporific influence of rotation seems referable also to its decreasing the galvanic activity, which it may accomplish in two ways, either by throwing out the electro-magnetism from the system on which the galvanic activity is dependent, or causing that on the surface to move in a circular manner thereon, and thereby prevent it from passing inwards to keep up the galvanic activity there. It is in this way that what is called animal magnetism produces, I conceive, its soporific effects, the hands, or whatever other substances are used to excite it, being made to describe circles on the body's superficies, until sleep is induced. I had been accustomed to consider animal magnetism as mere deceptive quackery, until informed of the extraordinary effects of it publicly exhibited by a Spanish quack at Tacna (Peru), upon a large portion of the population there, and in presence of individuals too acute to be deceived, and too honourable to lend their name to any species of imposition; though the operator naturally made himself contemptible in their eyes, by avowing not only its capability of curing diseases, but of revealing the situation of hitherto hidden gold and silver mines, during the opiate kind of dreams to which it gave rise. Some who witnessed the facts, ascribed them, as is usually the case, to the imagination; a power, no doubt, possessing immense influence over all the bodily functions; but when we consider that the superficies of the human body is covered, like the superficies of every substance, living or dead, by a mass of electro-magnetism, we may presume that the disturbing of the usual motions of the latter, must have considerable influence also over the above functions.

Should the excitation of a circular motion among the currents of the electro-magnetic elements be the real cause of the soporific effects produced by animal magnetism, its failure in many cases may be ascribed to the part of the human body operated upon, and the operating body, being both in the same state of electricity, and consequently repelling each other. Thus in a human body stretched horizontally in the northern hemisphere, the under part will be magnetic and the upper electric; and should the outspread fingers be made to describe the circles upon it, they will be magnetic when dependent, and electric when elevated; so that to produce currents in the upper part of the body, the fingers must be magnetic, and *vice versa,* if in the under part of the body; because they will then attract instead of repel the substance they are intended to excite a motion in, and thereby draw a current of it after them. That many of the popular charms cure disease by their influence on the imagination there can be but little doubt, because upon it only can many of them act; but in local diseases the curative effect may, I conceive, be often ascribed to the circular motion given to the electro-magnetism of the superficies, by the circles usually described on such occasions, by the fingers of the operator, round the seat of the disease, during the mumbling over of the mystic words through whose influence the cure is supposed to be effected. Substances are considered narcotics which produce a sedative effect upon the system; an effect arising from a diminution of action in all the bodily functions, whatever the nature of these may be. Now as both electricity and magnetism in excess, as well as electric and magnetic substances in large doses, excite a sedative action; so electricity and magnetism in small quantities, as well as electric and magnetic substances in small doses, may be presumed to excite a stimulant effect, and such indeed seems to be the case; heat and cold in moderation, as well as spirits and opiates in moderation, acting uniformly as stimulants; the effect of the dose, however, being naturally proportioned to the amount of electricity existing in the body at the time.

But as recrementitious diseases, viz. those of a stimulant or electric nature, and excrementitious diseases, or those of a sedative or magnetic nature, are apt to terminate in each other, hence great caution is requisite when such diseases so alternate with each other in the system, as to the mode of treatment pursued; because sedatives in excess during the stimulant paroxysm may excite a too powerful excrementitious action, and in the same way stimulants in excess during the sedative paroxysm may excite a too strong recrementitious action, by either of which, in excess, life may be destroyed. Several of the types of fever afford an illustration of this, but the disease called delirium tremens the best of any; bleeding in some cases of this having been of decided benefit, and in others productive of fatal results, the error arising from being either employed continuously or else carried too far, and hence a medium treatment is, on this account, considered the safest to pursue; namely, the exhibition of purgatives in moderation, to excite a moderate excrementitious action, and that of stimulants in moderation, to excite a moderate recrementitious one, so that by the moderate use of two opposite remedies an equilibrium between the above two actions may be attained.

STIMULANTS.

THESE may be divided into the active stimulants, producing an immediate stimulant effect, such as food, spirituous liquors, tea, coffee, &c., and slow stimulants producing a slow stimulant effect, such as various of the non-purgative neutral salts, various of the metallic salts and oxides, &c.; the difference of effect between the two being probably owing to the different facilities of their decomposition, so that the active stimulants being decomposed in the intestines, would naturally produce a quicker excitement than the slow stimulants absorbed into the circulation before decomposition was effected in them. This view seems corroborated by stimulants in excess producing a sedative, or excrementitious action, consequent on the primary stimulant, or recrementitious one, which would naturally be the result when the stimulant substances were in too large amount to be *wholly* decomposed in the recrementitious vessels; the undecomposed portion of them now passing into the excrementitious vessels, and consequently causing by its decomposition there an increased galvanic action throughout them, so that their secretions being of a fluid excrementitious nature these would be poured out in greater quantity.

ALTERATIVES.

These may be either stimulants or sedatives, the name signifying simply a capability of altering diseased action, or, in plainer language, translating of it from one class of vessels to another: the stimulants changing the action from the excrementitious to the recrementitious vessels, and the sedatives from the recrementitious to the excrementitious vessels. Proper caution must, however, as I have before remarked, be observed, not to push either course of treatment too far, in case the new action produced should be so powerful as to be equally prejudicial to bodily health with the old one which it succeeded.

I have already exemplified that either electricity or magnetism in excess retard the decomposition of bodies, and to this excess of electricity in the slow stimulants, and of magnetism in the slow sedatives, may probably be ascribed the slower decomposition and consequent tardier action of the above than of the more active; and to this proportionate tardiness of decomposition, indeed, even the recrementitious and excrementitious remedies may, in a great measure, owe their respective effects; because electricity being more powerful in its attractions and repulsions than magnetism, the electric or recrementitious remedies would therefore be decomposed before the magnetic remedies, the latter of which passing into the excrementitious vessels, in which the recrementitious terminate, before decomposition commencing in them, would consequently thus excite an increased galvanic action there.

All sedatives tend to increase the fluid secretions, and to diminish thereby the solid secretions, and consequently the body's solid bulk; while all stimulants tend to increase the solid secretions, and thereby diminish the fluid secretions, and consequently to increase the body's solid bulk; there being little difference between a recrementitious disease excited by mercury, salted, or easily digestible food, or ardent spirits; the same enlargements of the bones and other solid parts, and the same spongy gums, salivation, and fœtid breath, being liable to ensue in all.

POISONS.

The active stimulants and sedatives operate as poisons in large doses, it being only in small doses that they operate as alteratives; producing death in large doses, as I have previously illustrated, by causing a cessation of galvanic action in the system. In medium doses they will cause death again by either the excessive recrementitious, or excrementitious action which they have respectively the power to excite, both actions being, however, usually blended in the deaths from medium doses, on account of recrementitious and excrementitious disease being so apt to terminate the one in the other; and hence thickening and redness in the coats of the stomach, as well as ulceration thereof, are generally met with in dissections of deaths from the various poisons.

EMETICS AND PURGATIVES.

Emetics exciting a contraction of the muscles of the stomach, and thereby ejecting its contents, their action must consequently consist in extracting the electro-magnetism from the muscles on which their dilatation depends.

In the motions of the involuntary muscles, as exemplified in the heart and arteries, the extent of their contraction by the withdrawal of electricity seems always to correspond to the extent of their previous dilatation by the electric infusion into them; and hence I conceive that the contraction of all the involuntary muscles, at least, must be induced by a large infusion of electricity into their fibres immediately previous to the above contraction. This view seems collaterally corroborated by the contractions excited by the electric shocks always corresponding in intensity to the intensity of these shocks. That emetics and the stimulant purgatives, therefore, should excite contraction of the muscular fibres of the stomach and intestines by a previous infusion of electricity into them, seems very probable, and is, indeed, in some measure, borne out by the three powerful emetic substances, sulphate of copper, sulphate of zinc, and mustard, giving out heat during their mixture with water, owing, most likely, to their containing a greater amount of mass-electricity than of mass-magnetism. The various remedies, again, which give out cold during their mixture with water, must contain a greater amount of mass-magnetism than of mass-electricity, none of such, that I can recollect, acting as emetics, but all operating excrementitiously upon the bowels, the skin, or the kidneys, as we find nitre, glauber, and Epsom salts to do. Hence, we have warm and cold purgatives; the first being chiefly indicated in excrementitious diseases, and the latter in recrementitious; the first acting as stimulants before a sedative action can take place, and the second exciting a sedative action eventually followed by a stimulant one, if the primary sedative one is not maintained by a continuance at short intervals of the cold purgative doses.

Some of the stronger poisons, such as arsenic and opium, operate as emetics, in large doses; their action, however, being instantaneous, while that of the common emetics is usually slow; therefore, as the electricity must be extracted from the muscles to cause them to contract, the above poisons must contain a considerable portion of electric attracting matter, in order to excite the above emetic effects. This seems evidently the case, from both arsenic and opium, in small doses, having usually a primary stimulant action; though this stimulant principle is now separated from the narcotic principle of the opium, in the substance known by the name of morphine, whose action seems to be of a directly sedative nature. Emetics, when not operating as such, usually produce a purgative effect, and hence the principal difference of action between the generality of poisons, emetics, and purgatives seems to be in the comparative facility of their decomposition; poisons and emetics being of easier decomposition, consequently undergo this in a great measure before leaving the stomach, while the more difficult purgatives are enabled to pass onward to the intestines, before decomposition has proceeded far in them, and consequently excite their peculiar actions there. The exact difference between the composition of human food, and of poisons, emetics, and purgatives, as far as regards their comparative electric and magnetic affinities, is an intricate question to decide; but certainly food, instead of affording healthy nutrition, frequently operates either as a poison, an emetic, or a purgative; often, indeed, combining more or less the actions of the whole three.

The above effects of food must arise either from the disproportion of electricity and magnetism in it or in the atmosphere, but generally from excess of magnetism in the one or the other, from the diseased action produced by bad food being generally of an excrementitious nature. Food in a state of decomposition is apt to produce such effects, though they are equally liable to arise from food not easily decomposable, or taken in greater quantity than the galvanic action in the stomach can digest. The palate here serves as a useful monitor as to what is required to render food wholesome, and if we only attend to its dictates, few bad consequences would accrue from any meal of the usual food to which it is accustomed: the common condiments, pepper, salt, mustard, and vinegar, being all respectively put in requisition by it, according as its judgment dictates; and in quantities, too, to render this food either more digestible or less so, as it finds the peculiar state of the stomach to require. The partial putrescency of food does not render it unwholesome, provided proper condiments be used; it being often necessary to let tough beef, mutton, and fowls, hang till this begins to take place, in order to make them tender, and thereby render them more easy of mastication as well as of digestion. Game, indeed, is considered unfit for use until putrescency has considerably advanced in it; finding, as is the case, that this renders it even more wholesome than in the fresh state, provided a proper mode of cooking be pursued. Hence the immene quantities of meat and fish yearly destroyed in London, might, by very simple means, be converted into wholesome food, and a great waste thereby prevented in the staples of life; boiling it with some lumps of charcoal destroying the fœtor, and salt and pepper rendering it agreeable to the palate, as well as salutary as an article of regimen.

During the prevalence of cholera, many fata cases are recorded as arising from the use of putrescent food; but the same was also observed from an over indulgence in fruit, and hence it would be unjust to draw general conclusions from the action of either at a solitary period, and thereby set both down as pernicious. When the cholera existed in H.M.S. Tyne, I remarked that the common doses of purgatives, to remove ordinary constipation in persons of full health, produced the most violent cathartic effects; and those accustomed to take occasional purgatives must have often remarked that the same dose which, at one period, may fail, at another operates in the most powerful manner; all doubtless arising from either the peculiar electro-magnetic state of the atmosphere, or of the person's own body.

ELECTRO-MAGNETISM.

This being the exciting cause of all the actions in the human body, hence in some diseases a continued galvanic stream kept up through the body, or any local part thereof, where there was a deficiency of action, might be productive of very useful results; while, in others, a saturation of the body with electricity solely, or with magnetism solely, might be equally beneficial. This saturation could, of course, be only accomplished by placing the patient upon an insulated bed, and connecting him with the electric or magnetic wire, according as either was required; insulating the bed upon both glass and resin, in order to render the process sufficiently secure. In excrementitious diseases the body should, of course, be saturated with electricity, and in recrementitious diseases with magnetism; a suggestion worthy of consideration in those terrible disorders, tetanus and hydrophobia, which have hitherto baffled medical skill. The magnetic wire might probably also be usefully applied in enlargements of the solid parts, from the excrementitious action, and consequent diminution of size, to which it would give rise. Iodine, a most successful application in such cases, I doubt not, produces a similar excrementitious action from being a sedative, and consequently a magnetic attractive body; but it is only applicable in external diseases, while the magnetic wire can be readily applied in several of the internal, by constituting it of gold, and insulating it in a caoutchouc bougie, or some other equally effective substance. In enlarged prostate the wire might be introduced through the rectum, into contact with the part, while in enlargements of the liver, the magnetic stream might be directed through the seat of the pain, as showing the channel to the disease. The stone in the bladder may be yet found reduceable by galvanic action, either by the application of two wires insulated contiguously in the same substance, or by that of the single wires, according as the stone was affected by acids or alkalies; that is, by magnetic or electric substances. The chief difficulty would be to know which of the two, electricity or magnetism, was most suitable for the decomposition of the stone, or whether it was of such a composition as to require the influence of both the wires. This might be guessed at by the chemical examinations of weak acids and weak alkalies injected into the bladder, the calculous matter soluble in the acids naturally requiring magnetism in excess to decompose it, and that soluble in the alkalies requiring, on the contrary, electricity in excess; because whether you introduce magnetism solely, or electricity solely, the one introduced would always attract a sufficiency of the other from the human body to enable it to carry on a local galvanic action in the part to which it was applied. The action, however, of the two wires would, I conceive, be the most effectual, provided the point of the bougie containing them could be applied directly to the stone, which would not be a difficult matter to those accustomed to use the sound: the bladder being necessarily filled in such cases with some imperfect conducting fluid capable of protecting its coats from the action of the wires. My friend Mr. Copland Hutchison, in an ingenious paper upon calculus, has proved the extreme rarity, if not actual non-existence, of calculus among seafaring men, which he attributes to the quantity of alkaline matter in their food. This alkaline matter being the muriate of soda, an active recrementitious substance, the active recrementitious action produced by it would tend to prevent excrementitious action, and the depositions consequently resulting therefrom: as a too high recrementitious action in all female animals is shown to prevent the generation of their species, which not being a substance requisite for the sustainment of any of the actions by which the female body is kept in health and vigour, is therefore an excrementitious substance as relates to the female body, as its ultimate ejection therefrom sufficiently proves.

PARTICULAR DISEASES.

PREFATORY REMARKS.

In both recrementitious and excrementitious diseases, rotation and insulation will be equally beneficial. Indeed, we often see nature attempt the latter by the formation of an oxidated crust, or scale upon the skin, in various cutaneous complaints, through which the progress of the complaint is checked. As a general rule, I think it must be beneficial to insulate the brain, in all acute diseases, seeing the powerful influence, either direct or indirect, which it exercises over every part and function of the body. This point was strongly impressed upon me in a case of inflamed bladder on board the Tyne; the patient's great relish for vegetable acids assured me that the action was recrementitious; and after bleeding, insulation, and other requisite treatment, he was at length enabled to pass his urine freely. Two relapses, however, induced me to consider the disease more particularly, and finding that the attacks always commenced when he attempted to pass his urine, and were preceded by great pain in the back, where the nerves of the bladder have their origin, I concluded, therefore, that the volition to contract the bladder was too intense for its irritable state, and that the brain must be consequently insulated also. After effecting this by means of tightly buond silk handkerchiefs, and directing not to urge too strongly the urinary flow, but await patiently nature's milder efforts, no further relapses took place, and a speedy convalescence succeeded.

MADNESS AND MELANCHOLY.

Both of these being diseases of the mental functions, consequently point out the brain as the active seat thereof; the increased excitement in the first showing it to be an electric, or recrementitious disease; and the diminished excitement in the second that it is a magnetic, or excrementitious one. As, however, recrementitious and excrementitious diseases so often alternate with each other, it is a great point to ascertain in compound diseases, if I may so term them, which of the two is the primary or principal affection, because to this the leading points of treatment should be mainly directed.

Rotation, that active remedy so successfully employed by Dr. Cox, as well as partial or complete insulation of the head, would, I conceive, be equally useful in both diseases; the first by equalising the electro-magnetism of the body, and the second by preventing a morbid application of it to local parts, while swinging in bed, to moderate the above morbid electro-magnetic introduction, and purgatives to promote the healthy state of the excrementitious bowel discharges, must be also beneficial in both, when due caution is observed. Ablution and friction of the skin should, also, never be lost sight of, because on an unhealthy state thereof disease must be more or less dependent, from its being the great medium through which the whole of the electro-magnetism, retaining the body in health, or throwing it into disease, is conveyed; the clearing of the skin, therefore, from morbid excrementitious matter, I should conceive to be quite as necessary to bodily health as the clearing the intestines therefrom, seeing that the functions of both are much upon a par as to their relative importance in sustaining the animal machine in a sound and vigorous state.

The science of phrenology seems destined to be of great service in the treatment of mental affections, because, when only one of the mental organs is diseased, the local remedies required may be applied solely thereto, without making the same general to the whole of the head, which in some cases may be of doubtful utility, particularly such where there is an increase of excitation in one organ, and a diminution thereof in another.

FEVER.

As far as my own observation extends, the brain seems to be the primary part affected in continued fever, and therefore insulation of the head after effective rotation will, I conceive, generally check it at the commencement. I found, indeed, insulation of the pained parts of the head alone, by means of lunar caustic, to accomplish this in five cases consequent on cholera, where the forehead pain, flushed face, peculiar excitability of the eye, hot skin, and quick pulse, predicted an incipient typhus: sound sleep, and a speedy cessation of all the above symptoms ensuing therefrom. Swinging in a cot in the interval between the rotations must be evidently of infinite service in all general diseases, and hence should never be omitted in acute ones. Ablutions, frictions of the skin, and purgatives, I have, in a preceding chapter, already sufficiently expatiated upon as remedies in general disease. All the above, when used with judgment, must be equally beneficial in both the recrementitious and excrementitious fever; but as I have never seen any species of continued fever that was not of a mixed nature, therefore the primary or leading action of the two must be the one to which attention should be chiefly directed.

Recrementitious action has always appeared to me to be the leading action in the various fevers I have met with; acid fruits and drinks being as much relished during the continuance of the fever, as salted and high-seasoned substances were after its cessation, when the excrementitious action by which the previous recrementitious fever had been cured was proceeding to too great an excess, and thereby made premonitory demands upon the palate for articles capable of checking its further increase. Cold affusion, as a general remedy, must be as often hurtful as beneficial, in recrementitious disease, from its temporary sedative effects being speedily followed by those of a stimulant nature; so that when recrementitious action is the leading disease, the cold applications must be *constant* (at least while the recrementitious action exists) to insure a beneficial result. When these cannot be made constant to the whole of the body, or it might appear injudicious so to apply them, the keeping up of a continued evaporation from the hands and feet might answer all useful purposes, seeing that the temperature of the whole body is so readily affected through them.

The period when cold affusion is most likely to be of service is during the excrementitious portion of the febrile paroxysm, when a sudden dash of a bucket of cold water over the body, followed by brisk dry frictions with towels, might cut the paroxysm short by the subsequent stimulant reaction which it would create. In a former chapter I have exemplified the fact of electricity in great excess acting as a sedative like magnetism; and hence, when such isthe case in the human body, a moderate application of cold or other sedative remedy will act as astimulant, by reducing the electric excess causing the above sedative effect.

When, therefore, excessive depression in the nervous and vascular system exists, it is an important point to decide whether excess of electricity or excess of magnetism be the cause thereof, from magnetic remedies being required in the former, and electric remedies in the latter. In the violent febrile affections where excessive recrementitious and excrementitious action alternate rapidly with each other, fatal consequences, however, must frequently ensue from excrementitious remedies being applied in excess in the former period of the febrile paroxysm, or recrementitious remedies in excess in the latter, in consequence of the excess of an opposite action to that which these remedies were intended to counteract, being induced by an excessive application of them singly. Thus, in many febrile diseases, where the great fulness of pulse, heat of skin, and apoplectic torpor of the brain, indicated an excessive stimulant or recrementitious action, a large bleeding, though affording instant relief, has often been the cause of death, from the excessive sedative or recrementitious collapse to which it has eventually given rise. In such cases, therefore, the bleedings must be small, to be safe; the securest way of proceeding, however, being to reduce the excessive stimulant action by the cautious application of cold, or by a gentle dose of some directly sedative remedy, in a similar way as we gradually reduce excessive magnetic collapse in a frozen limb by the cautious application of stimulant remedies, which applied in excess would ensure its destruction by the excessive electric or stimulant action to which they would eventually give rise.

Charcoal being a highly combustible body, and a good electric conductor, as well as the most efficient substance known for preserving dead matter from putrefaction, or of checking this when it has commenced; hence I would consider charcoal powder as the most powerful stimulant or recrementitious remedy that could be administered in the excrementitious stage of fever, particularly in the advanced state, when excrementitious action begins to exceed the recrementitious, and thereby eventually either cures or kills.

The as great regularity in the return of unremittent paroxysms as the revolutions in the planetary and cometary bodies round the sun, point to something like an analogy between the causes upon which both are dependent for this coincident uniformity, and I conceive the regularity of the intermittent revolutions to be explainable on principles assimilating to the planetary revolutions; viz. by the magnetic currents ushering in the primary cold paroxysm, circling in a definite period round some of the surfaces of the body. There are three surfaces where the mass-electricity and magnetism could be contained, for each to follow the respective courses of motion I have ascribed to them; viz. the skin, the peritoneal lining of the abdominal parietes, and the peritoneal covering of the intestines. The greater the predominance of electricity, or heat, upon a surface, the more rapid will naturally be the electric and magnetic motions thereon; so that I would attribute quotidians to the magnetic current circling round the intestines, tertians to that circling round the internal abdominal parietes, and quartans to that circling round the skin. From the feelings in my own case, as well as of those labouring under intermittent disease, the cold paroxysm seems to be induced on these currents reaching the spine (the origin of many important nerves), from the first sensation of cold being experienced there. It is a curious fact, that the internal or external application to the body of any substance exciting galvanic action, will bring on an intermittent paroxysm earlier than usual, when the above is applied near to the period of the paroxysm's expected return. I have observed eating frequently produce this effect; and in my own case, the first premonitory symptoms experienced were on taking a glass of Madeira and a biscuit at luncheon time. The Peruvians, from having intermittent paroxysms, so often brought on by washing or shaving, cannot therefore be persuaded to attempt either when labouring under this complaint, and indeed any medical man who advised these would risk the loss of his practice.

CHOLERA.

In the section upon epidemic, I have pourtrayed the influence which the sol-lunar attractions and repulsions must naturally have in giving a westerly tendency to the magnetic matter composing it; and hence it is, on this account, unlikely that the epidemic effluvia causing the recent cholera in Europe, will return again thereto by a westerly route. The great branches of the Mississippi will act in some measure as barriers to its westerly tendency in America, by carrying portions of it downward into the Mexican Gulf by the attractions of their current; while in the event of its crossing into the southern hemisphere, the repulsion of the magnetic zone there will diffuse it more equally through the atmosphere, and consequently make it less intense in its attacks. It appears to commence as an excrementitious disease, and to continue so through all its stages: being characterised even at the outset by an increase of the pale magnetic secretions, and a decrease in the coloured electric ones, such as the bile and the urine; while the blackness of the blood, muscular spasms, shiverings, and diminution of bodily bulk, evince the magnetic action going on.

The blood we see to be reddened by the application of oxygen, which extracts the magnetism on which its dark tint depends; while the darkening of it by certain of the acids, and the reddening of it by certain of the non-purgative salts, may be ascribed to the former imparting magnetism, and the latter electricity to it, according as either of these latter bodies exist in excess over the other, in the state of mass, in the said acids or salts.

The ease given by vomiting, in cholera, points out the benefits to be derived by the ejection of the magnetic epidemia from the body, and I doubt not but many cases have been made to terminate fatally through the injudicious checking of this highly salutary process. In fact, in cholera, as well as in all cases where this occurs, it ought to be encouraged by plentiful dilution, in order the sooner to cut short disease, by the ejection from the system of the electro-magnetism causing it. But as it is frequently found impossible to produce vomiting in the violent cases of cholera by means of the usual emetics, I conceive this would be readily effected, even in the most obstinate of them, by rapid rotation, which, even if failing as an emetic, would produce the similar result of ejecting the epidemia; while by tightly enveloping afterwards of the whole body in folds of flannel, the epidemia would be prevented from re-entering it after repulsion, and the cure be consequently completed.

The above remedies are applicable to the treatment of cholera, whether this be conducted on the stimulant or sedative principle, both of which have been successfully employed, the error liable to be committed being the mingling of the two, so that the one is thereby made to counteract the other. Should the recrementitious or stimulant treatment be resolved on, and collapse have taken place, the patient, after rotation to vomiting and approaching syncope, should drink freely of warm stimulating liquids, be enveloped in folds of flannel, have recrementitious remedies, such as charcoal, salt, calomel, &c. administered, the hot stomach-pan applied to the abdomen, and hot substances to the feet; gradually reducing the above when the stimulant reaction took place, in order to prevent the too violent recrementitious action, so liable to be induced by the too sudden checking of the previous excrementitious one. If, however, the sedative or excrementitious treatment be resolved on, the patient, after rotation to vomiting and approaching syncope, should be lightly covered, drink freely of iced water, and have sedative remedies exhibited to assist the others, there by imbuing the body with a sufficiency of magnetism to check the deadly excrementitious action going on, upon the principles previously explained of electricity in excess, or magnetism in excess, putting a stop to galvanic action. Besides putting a stop to the magnetic action going on, and thereby curing the cholera by excrementitious remedies, the simple carrying of the above magnetic or sedative action to excess, by the constant exhibition of magnetic remedies, would tend to bring on an electric or stimulant action, and thereby equally effect a cure, in consequence of the law in the human system, that the greater the intensity of the primary action, the sooner will the secondary action ensue, and the greater be the intensity thereof. This is well exhibited in intermittent fever; the *intenser* the cold stage the *shorter* being its duration, and the intenser and *shorter* also the succeeding hot stage.

This alternation of electric and magnetic action in the system, seems referable to the strong attraction of electricity and magnetism for each other; so that when electricity is in excess in the body during recrementitious action, it will attract magnetism strongly toward it, and when magnetism is similarly in excess during excrementitious action, it will attract electricity toward it; so that the greater the primary excess of the one, the greater will be the subsequent amount of the other thus attracted, and the sooner therefore the peculiar action excited by either be put a stop to, provided the body be sufficiently strong to withstand the intensity of the primary attack.

The ease primarily afforded by iced drinks in cholera, seems attributable to the sedative influence of their action, from magnetism or cold being thus applied in excess near the seat of the disease; while the vomitings to which they eventually give rise on becoming heated by electric absorption, tend to render this cessation from diseased action permanent, by ejecting the magnetic epidemia exciting it from the body. In all the cases of cholera on board the Tyne, caustic applications over the cramped portion of the abdomen never failed of giving relief, their beneficial influence being doubtless as much owing to their translating of the galvanic action from the internal parts to the surface, as to their insulating effects upon the latter. Tight ligatures round the extremities have been found highly useful in arresting the progress of cramp, and the cold stage of intermittent fever, both magnetic paroxysms, and having found the same result produced in several cases of severe dysenteric gripings, I am consequently disposed to believe that similar applications round various parts of the body would be found advantageous in cholera. Their utility must, I conceive, depend upon the resistance opposed by them to the onward motion of the bodily electricity, thereby exciting the latter to stronger efforts in order to overcome this resistance, and in consequence thereof eventually producing a general stimulant action throughout the system.

SCROFULA AND SCURVY.

Both of these are primarily recrementitious, as evidenced, by enlargement of the solids always preceding the excrementitious suppurations, ulcerations, perspirations, diarrhœas, and salivations, which usually accompany one or other of the above complaints; the correctness of this view being farther demonstrated by excrementitious remedies being found best adapted to the general treatment of them in our attempts to effect a cure. In scrofula there is a natural over-activity in the recrementitious vessels, while in scurvy the over-activity is produced by the too stimulant nature of the diet. People of two distinct species of hair, and complexion, are most prone to the attacks of scrofula, viz. those of yellowish hair and blue eyes, and those of straight black hair and black eyes; while persons of every colour of hair seem equally liable to scurvy. The over intense recrementitious action in scurvy may be caused either by an excessive use of salted meats, spirituous liquors, mercurials or other powerful recrementitious substances; or to the recrementitious food, constituting the diet, being too digestible, and consequently too nutritious, either from being in a too fluid state, or else in a partial state of decay.

Scurvy will naturally be more readily excited by the above substances, when the persons lead inactive lives, or do not use a sufficiency of excrementitious vegetables, or water: active exercises naturally accelerating the circulation of all the vessels, and thereby pushing on the matter of the food absorbed, from the recrementitious into the excrementitious vessels, before a thorough galvanic decomposition of it in the former had been effected; while water being the principal constituent of the excrementitious discharges, hence the necessity of supplying a sufficiency of it for excrementitious purposes, so as thereby to prevent recrementitious disease.

Water containing eighty per cent. of oxygen, must, consequently, I conceive, contain mass-magnetism in excess, and hence to this may partly be owing its use as an excrementitious remedy; while the fact of the sulphate of iron and other recrementitious salts giving out heat when dissolved in it, and the sulphates of soda and magnesia, and other excrementitious salts, giving out cold when so dissolved, afford not only a curious illustration of the views previously promulgated of recrementitious remedies containing mass-electicity in excess, and excrementitious remedies mass-magnetism in excess, but point out the cause of the salutary effects produced by the exhibition of nitre in scurvy, which giving out cold during its solution in water, thereby shows it to contain mass-magnetism in excess, and, consequently, that its effects upon the system must be excrementitious. A further illustration of the above view is afforded by bodies giving out cold, during the action of water upon them, always, as far as I recollect, affording colourless solutions; while those which give out heat, when acted upon by water, afford solutions corresponding in tint to some of the sun's magnetic rays, even though the substance dissolved be colourless.

The primary or leading action in scrofula and scurvy being, therefore, recrementitious, hence the salutary effects that have been found to result from excrementitious treatment in them:—a vegetable regimen and the exhibition of such substances as excite the excrementitious discharges, with an abstinence from all articles of diet which excite recrementitious action, being seldom found to fail in effecting a cure, while the recrementitious action is *still* the more active one of the two.

Scurvy is a very rare disease at the present period to what it was in former times, which may be readily attributed to the more perfect mode of preserving the provisions now than formerly, whereby they are rendered less decomposable in the stomach, and consequently less recrementitious, as well as the more liberal supply of water for drink, the more general cleanliness and ventilation, and more general attention to the comforts of the men. I conceive, however, that the more liberal use of tobacco, both in smoking and chewing, has had no small share in producing this result, its action upon the system indicating it to be a powerful magnetic substance; thereby showing that its effects upon the body must be similar to those of vegetables, vegetable acids, and other excrementitious substances. Merchant-ships are indeed, in modern times, quite as free from scurvy as ships of war, although less attention be paid in them to cleanliness and ventilation, and no antiscorbutic remedies be furnished for the longest voyages; the seamen, however, making up for these deficiencies by the more active lives they lead, but particularly, as I conceive, by their using tobacco in one form or another during every watch. The use of tobacco must indeed be most salutary to those indulging in habitual excess in stimulant food or drink, by preventing the enlarged livers and other recrementitious diseases of the solids, which might otherwise ensue. It must be observed, however, that as diarrhœas and other excrementitious discharges often eventually cure the primary recrementitious disease: hence, when such is the case, the excrementitious affection may be the one requiring attention from its proceeding to too great an excess.

It is on this account, I conceive, that calomel, exhibited to touch the gums, was found beneficial in several of the scorbutic bowel complaints at the Millbank Penitentiary, a scorbutic disease evidently brought on those by an over-nutritiousness of the food, and a want of that due exercise requisite for promoting the excrementitious discharges.

In the above diseases, characterised by a primary enlargement of the solids, the fat, a solid substance, seems to be but little affected thereby; on the contrary, a morbid enlargement of the fat seems rather to denote a healthy state of the body than otherwise. This may be accounted for by its being a sort of medium between the solid and fluid secretions already treated of, so that its vessels, by their increased activity, will serve the useful purpose of keeping up a balanced action between the two other species of vessels, and thereby retain them in a healthy state.

SCROFULOUS, OR TUBERCULOUS CONSUMPTION.

When scrofulous tumours in any part of the body suppurate, while others are still in a state of solid enlargement, a mixed disease is thus constituted; the action in the ulcerated, or suppurated tumours, being excrementitious, while that in those still progressing in solid enlargement, is recrementitious. We can, however, beneficially adapt a mixed treatment to this mixed disease, when the ulcerated parts are situated externally, by making the general remedies recrementitious; but when important internal organs, like the lungs, are so affected, where local remedies cannot be applied, the treatment must be exceedingly embarrassing; and hence the great utility of checking scrofulous action in youth, by suitable regimen, and suitable medicinal remedies, so as to prevent the many untractable diseases in particular parts to which it gives rise. General excrementitious remedies will tend to increase the morbid ulceration and discharge in the suppurated tumours, while general recrementitious remedies will tend to increase the solid enlargement of those still affected with recrementitious action; but when the patient had a general relish for cooling fruits and cooling drinks, I would not hesitate to employ excrementitious diet, and administer cautiously excrementitious medicines, even should there be considerable expectoration or other excrementitious discharge. Rotations, shaving, and insulation of the head and chest, and spongings and frictions of the body, will be useful, whatever species of action is going on; but when scrofulous consumption does not speedily yield to the treatment pursued, the patient ought to be removed to the southern hemisphere, where the magnetic polarity of the upper part of the body, and the more uniform diffusion of magnetism through the atmosphere, will, in all probability, arrest the disease, if timeously had recourse to.

BRONCHIAL CONSUMPTION.

THIS is an excrementitious disease of the bronchial tubes of the lungs, and eventually destroys, either through the profuseness of the discharge, or the gradual closing up of these tubes, by the contraction of their circular fibres, as constrictions in the urethra and rectum are produced by similar excrementitious diseases in these parts, viz. gleet and chronic dysentery. Bronchial consumption has indeed been denominated, by some, the gonorrhœa of the lungs, and I doubt not but the matter of it would be found equally capable of propagating a similar disease, if brought in contact with the bronchiæ of a healthy lung. It is, I believe, the disease denominated in England "the galloping consumption," from the rapidity with which it carries off its victims, while it is the common consumption of the southern hemisphere, being infinitely more frequent there than in the north, though generally slower in its progress toward a fatal termination. The only two cases of death from this disease in the southern hemisphere that I have had an opportunity of examining, showed a complete shrivelling up of the greater portion of the lungs, in consequence of the contraction and obliteration of the bronchial tubes, muco-purulent matter filling up the open ones with a few sacs thereof, in the substance of the lungs, near their junction with the trachea. This appears to be the species of consumption so successfully treated by the Rev. Mr. Stewart with stimulating regimen, cold spongings, and frictions, and the one in which touching of the gums with mercury has been found beneficial. A removal to the southern hemisphere would only aggravate this disease, an account of magnetism, the cause of it occupying the upper part of the body in the upright position there, and magnetism being more equally diffused through its atmosphere;—the hot latitudes of the northern tropics being the best adapted to its cure,—those latitudes, in fact, which will necessarily be the most injurious to scrofulous consumptive cases.

Scrofulous consumption is most common during the early stage of life, being seldom met with after the age of forty, when the advance of grey hairs enables magnetism gradually to preponderate over electricity in the body, and excrementitious action thus to keep the recrementitious in check. Bronchial consumption, on the contrary, is most common after the period for scrofulous consumption is past, the constitution becoming more and more susceptible to its attacks, and the disease more and more fatal as life advances. The bronchial inflammation exciting it, is indeed frequently epidemic, carrying off, under its name of influenza, the greater portion of the elderly people whom it assails.

A very common belief exists of consumption being occasionally infectious, and which, I think, not an improbable supposition, as regards the bronchial species of it, when a person of susceptible habit was exposed to the near inhalation of the foul air emitted from a highly diseased lung.

GOUT AND RHEUMATISM.

Both of these diseases are primarily recrementitious, ending in recrementitious action. They are sometimes conjoined, constituting the complaint called rheumatic gout; but in a more distinct state. Gout affects principally the ligamentous capsules of the small joints, and rheumatism those of the larger, as well as occasionally the ligamentous partitions of the muscles;—the ensuing excrementitious actions of the former producing chalky-like depositions, and that of the latter, serous and gelatinous depositions. That the recrementitious action in rheumatism exists in the muscular fascia, is evidenced by the muscular thickenings or contractions which attend it, owing to the electricity on which muscular relaxation depends, being withdrawn therefrom to supply the electric or recrementitious action going on in the tendinous capsules enveloping them. In the acute stages of either, I would not hesitate to adopt the treatment pointed out in scurvy; but when the excrementitious action prevails over the former, and the chronic stage of it is thereby produced, the doses of the remedies should be lessened, and even a moderate proportion of stimulants might eventually be found beneficial.

Since the preceding views relative to the causes of diseases were taken by me, I have pursued the excrementitious plan of treatment with singular success in all cases of rheumatism that have come under my care, keeping the patient on low regimen, using daily warm spongings and frictions to the body, preserving the bowels in an open state, and exhibiting the Dover's powder in small doses throughout the day. I prefer small doses of medicines at short intervals, to large doses at long intervals, because a constant gentle action, corresponding to the nature of the medicines prescribed, is thereby kept up;

whereas, if large doses be given at long intervals, a reverse action of that excited by the medicines may take place in the interval, and thereby protract the cure. The benefits of this practice have been well proved to me in the comparative rapidity with which rheumatic cases have recovered since I administered the Dover's powder in small and frequent doses, to what they did formerly when a different course was pursued. In the most obstinate cases of lumbago, the hot stomach pan applied constantly to the back, has never failed of effecting a cure in a couple of days at the most. The hot vapour baths relieve at once the pain of the muscular spasms, by the electricity which they infuse into the muscular fibres causing an elongation or relaxation of them, while the excrementitious perspirations to which they afterwards give rise, are equally beneficial in arresting the recrementitious action going on in their tendinous envelopments. Rheumatism being a more general disease than gout, I would, consequently, encircle tightly the whole body in dry flannel, after each rotation, warm sponging, and friction; but in gout it would be sufficient to confine the flannel envelopment to the part affected, with a padding of cotton wool over it, to insure a more perfect insulation.

CUTANEOUS DISEASES.

These being the sequelæ of recrementitious action, hence by the cure of the primary disease, the secondary will cease as a matter of course. This is particularly obvious in the rose rash of the face, where local applications are only of a temporary benefit, as long as the primary recrementitious action in the system which causes it, exists. In many constitutions it is not only necessary to abstain from stimulant solids and stimulant fluids, but to keep up an excrementitious discharge from the bowels for several days, by means of the Epsom and other cooling salts, before local remedies are of much avail. I have never failed of curing the most inveterate local cutaneous affections by the caustic solutions; the porrigo barbæ generally requiring, however, several touchings, before a cessation of its morbid action was attained; removing the crusts and pruning down the hairs previous to each application.

DELIRIUM TREMENS.

This is a primary recrementitious disease, terminating in excrementitious action, wherein the transitions from the one to the other being as sudden as violent, consequently great caution is requisite in the treatment pursued, because the remedies that would be salutary when the first action is going on, would be pernicious in the second; while even those requisite in either would be productive of bad results, if administered in large quantities, from the too intense specific actiion they would respectively excite, only tending to bring about a more rapid and intense action of a contrary description, through which the disease would be necessarily prolonged, even if a fatal crisis should not, in the interim, be occasioned. Moderate rotations, cold sponging, frictions, and gentle evacuants must, however, be salutary, whatever species of action may be going on. The many well-attested cases of spontaneous combustion show to what an extent galvanic action may proceed, and that the popular belief of a blue flame issuing at times from a person's mouth, who has drank stimulants to excess, may have a good foundation. As far as chemical knowledge at present extends, spontaneous ignition in such cases could only arise from the gaseous matter emitted from the lungs containing phosphorus, but if any inflammable gas happened to proceed therefrom, the approximation of a candle would be sufficient for this purpose; hydrogenous gases, capable of being so ignited by a candle, being, in fact, frequently formed in water casks at sea, as well as in the bowels of animals, particularly the horse, so that a similar formation of it in particular cases in the lungs is a perfectly probable matter.

CANCER.

THIS is another specimen of a recrementitious disease, ending in, or rather alternating with, an excrementitious one; the solid enlargement and ulcerated decrease alternately progressing until death ensues through the extent of their combined ravages. The remedies found most successful by medical men have been caustics, metallic oxides, and pressure pads over the dressing, all deriving the principal portion, at least, of their beneficial influence from the insulating effect which they produce on the surface of the sore. It is, in fact, by a similar plan to this that empirics have cured so many cancers, inveterate tumours, and ulcers, applying primarily some potent caustic, and afterwards further insulating with some strongly adhesive plaister "to draw out," as they term it, the cancer. It was by a similar mode to this, that an empiric gained great reputation in a town where I once resided, in the cure of cancerous stiled substances, which after being extirpated, were preserved hanging down in bottles, "like roots of plants" (as expressed by a friend), the general certainty of the healing up of the sore after this extirpation, bearing ample testimony to the merits of his practice.

In accordance with the above view, I would cauterise freely the ulcer with nitrate of silver, pad it well with lint, and over it, as well as a considerable portion of the surrounding parts, place slip upon slip of adhesive plaster, after which cover all with a thick padding of cotton wool, and finally bandage down tightly, in order to exclude effectually the atmospheric air, and consequently the atmospheric electro-magnetism from the diseased superficies. As long as ease was secured, I would be in no hurry to renew the dressings, because the above feeling would be a sufficient guarantee that a sanitary action was going on, while each renewal would only serve to admit a fresh supply of electro-magnetism for the feeding of the disease.

LOCAL POISONS.

It is a disputed point, whether the poison from the bite or sting of reptiles or insects, be carried into the system through the nerves, the absorbents, or the blood vessels. However, as insulation of the part poisoned, by means either of cauterisation or cupping-glasses, prevents the accession of diseased action, it may be presumed that the poison so imbibed, attracts to it similar electro-magnetic matter to that constituting its active properties, and that it is carried into the system by the *vis a tergo* force of the latter; for how otherwise could the very small quantity of virus primarily imbibed, be capable of producing such fatal results, or the above insulating remedies present such an effectual barrier to its introduction. Whether the action excited by these poisons be recrementitious or excrementitious, that is, whether electricity or magnetism be the leading cause of their actions, I have not sufficient proofs to draw satisfactory conclusions from, because the drowsiness caused by most of the stronger poisons may be as likely produced by excess of electricity as excess of magnetism, seeing that both in excess produce sedative effects.

The great benefits derived from the suction of poisoned wounds point out a similar powerful suction of all painful punctured wounds, until ease was obtained, as the most likely remedy to obviate the poisonous or tetanic effects that might result therefrom; particularly if care be taken to cauterise them well afterwards, and otherwise effectually insulate them from the electro-magnetism of the atmosphere. Rotation, until copious vomiting and approaching syncope ensue, cannot fail, I should conceive, of being highly useful in all cases of bites or stings of poisonous or rabid animals; the vomiting which so rapidly occurs in the bad cases of poisons, pointing out the means through which nature attempts to effect a cure, by the restoration of an electro-magnetic equilibrium in the body, drinking freely, of course, at the same time, to assist nature's efforts, because the greater the quantity of the tepid water drank, the greater would naturally be the amount of electro-magnetism ejected along with it, in consequence of its attracting that of the body, in a ratio corresponding to its bulk.

TETANUS.

The morbid spasmodic rigidity of the whole muscular system would seem to denote the primary action in this disease to be excrementitious, but I am disposed to believe that, like rheumatism, it is a recrementitious one of the muscular sheaths, thereby causing a contraction of the contained muscles, by the withdrawing from them of the electricity on which their elongation depended. If such be the case, excrementitious treatment must be the one required, using at the same time frequent rotation to vomiting and approaching syncope, with insulation of the body in the interim of the rotations, by means of flannel folds and cotton paddings.

TIC-DOLOREUX.

In the case of this disease at Islay, previously referred to, the insulation of the part where the nerve emerged from the skull, was found sufficient to effect a cure, but this might not be always so; I conceive, indeed, that the exciting cause of the tic-doloreux may generally be traced to some local irritation, on the removal of which it will naturally subside. Every medical man must have indeed witnessed permanent or recurring tumours, and ulcers about the face and gums, occasioned by diseased teeth, which speedily yielded on the extraction of the latter.

A short time ago, I was attacked with a tic-doloreux affecting all the branches of the portio dura, the pain, however, being naturally most acute at the point before the ear, where this nerve emerges from the brain, by pressure upon which with the forefinger, I was not only enabled to keep the pain completely under, but to moderate it greatly for some time afterwards. On removing the finger one day, after a short pressure, I felt a sudden painful twinge proceed from the front of the upper jaw toward the ear, which induced me to examine, by finger pressure, the parts around; when the cause of the disease was soon indicated to be a diseased eye-tooth, by persevering pressure upon the root of which, I at length succeeded in curing a disease, without the extraction of the tooth, which had become such a torment to me as to destroy many a night's rest. Every part of the face and mouth ought, therefore, to be carefully examined in such cases, as the cause of it may as frequently lie in some irritable tumour, pimple, or ulcer, as in an irritable tooth.

SYPHILIS AND GONORRHÆA.

Both are primarily excrementitious diseases, the recrementitious bubo or swelled testicle in which, occasionally, they respectively terminate, being caused by the translation of the galvanic disease from the fluid secreting vessels to the solid secreting vessels. The swelled testicle in gonorrhæa is, in fact, usually produced by the incautious use of cubebs, stimulating injections, or some such strongly recrementitious general or topical remedies; the translation of the galvanic action being in this case well exemplified in the gonorrhæal discharge ceasing when the testicle begins to swell, and the tumefaction again decreasing when the above discharge is excited to return. In both gonorrhæa and chancre, mercury must be useful when not carried further than the creating of a slight tenderness of the gums; while in bubo and swelled testicle it must be hurtful until free salivation is produced. According, therefore, to the views pourtrayed relative to the primary recrementitious action of mercury, I would attribute the enlargements of the bones and other solids in syphilis, rather to the mercurial than the syphilitic action; two cases of eruptions being the only secondary symptoms I have seen during the fifteen years that I have now omitted the exhibition of mercury in syphilitic disease. I have no doubt the accounts relative to the prevalence of syphilis among the South Sea Islanders, have originated in the belief that the buboes so common there, were venereal, whereas they are caused by the downward electric attraction of the southern hemisphere, by which scrofulous action is excited in the glands of the groin instead of in those of the neck.

Glandular enlargements in the groin are in fact the pests of every ship of war on the South American station, east as well as west of Cape Horn; while among the aborigines and English settlers of New Holland they are equally common, as well as among all the natives of the Southern Islands where my inquiries have reached, being the usual precursors of the elephantiasis so prevalent there.

ENTERITIS.

THIS is evidently a recrementitious disease of the muscular intestinal coats, as evinced by the abdominal tumefaction arising from the surcharge of the muscular fibres with electricity, through which they are elongated and consequently relaxed. In inflammation of the other intestinal coats, as exemplified in acute dysentery, the intestinal muscular fibres are, on the contrary, contracted, owing to the electric matter which elongated them being now drawn off, for the supply of the morbid electric action going on in the other coats.

as the medicines; small bleedings in the former being more likely to do harm than good, while in the latter large bleedings would tend to fatal results.

GUN-SHOT WOUNDS.

THE effects of gun-shot wounds upon the constitution are similar to those of any other bodily hurt. If the mind be highly excited, they will produce but a comparatively trifling mental depression to what they otherwise would do when in its ordinary equilibrium; therefore, while there might be a necessity in the latter for administering stimulants, and even of waiting a little until the mental collapse produced by the injury had subsided, before performing amputation, in the former, great danger would necessarily result from such delay, in consequence of the mental collapse that might be anticipated to follow the primary excitement, rendering such a depressive mental operation as amputation too hazardous to be attempted.

Whenever, indeed, a severe bodily injury of any kind is inflicted, in the ordinary state of the animal spirits, fainting is liable to occur, if proper stimulant means be not employed; and hence how dangerous would it not be to amputate under such circumstances. In sea battles, a few broadsides will suffice to rouse the most lethargic; but in land battles, while those engaged in the front lines will necessarily be strongly excited, those in the rear lines may be, on the contrary, depressed, from seeing their comrades fall thick around, without being able to return a single exciting shot at their unseen enemy.

PREGNANCY.

THIS is a recrementitious action as regards the fœtus, and although the recrementitious vessels of the mother be actively employed therein, yet the action may, in some measure, be considered an excrementitious one, as regards her, from the fœtal growth abstracting from, instead of adding to the solids of her body, and the fœtus being only pushed into maturity to be eventually ejected, like any other excrementitious substance. When the fœtal recrementitious action becomes too intense, an excrementitious action to check it, generally ensues in the mother, which, if carried to too great an excess, will naturally cause the death of the child, by depriving it of its nutrition; and, consequently, occasion its speedy discharge from the mother's body. It is evidently, indeed, through some excessive excrementitious action in the mother, the consequence of previous excessive recrementitious action, that abortion is generally produced; such being comparatively rare after the fourth month, when the morning sickness keeps the recrementitious action in check, by ejecting the electricity exciting it from the mother's body.

A great excess in any of the excrementitious secretions of the mother after conception, is found indeed always to portend danger to the fœtal life, whatever class of excrementitious vessels be affected; whether those of the bowels, the kidneys, the vagina, or the skin. When therefore too powerful recrementitious action is found to be the *remote* cause of abortion, by the excrementitious action which it eventually gives rise to, this recrementitious action should be kept in check by excrementitious regimen, as well as by frequent gentle rotations, to eject the electricity from, or equalise it in the body, according as the cases require. The beneficial influence of vomiting and low regimen, in preventing abortion, was once pourtrayed in a singular manner to me in the case of a lady who had miscarried five times, and embarked for England while about a month *enceinte* of her sixth child. Abortion had always taken place in the second or third months, but the sea-sickness, which assailed her, exciting almost daily vomitings, and diminishing at the same time her inclination for food, enabled parturition to go in a healthy manner until the proper period was completed, and a full formed child produced. Repeated gentle rotations during the day, would, I conceive, alleviate greatly the morning sickness found at times so distressing, while at the same time answering all its useful purposes in checking recrementitious action.

BARRENNESS.

THE proximate cause of this will be generally found to be either excrementitious disease existing in the uterus at the period of coition, and thereby preventing conception from taking place, or else induced therein after conception, by a too powerful recrementitious action in the female body. It is, however, to the latter more remote cause that the greater proportion of the cases of barrenness may be attributed, from all animals as well as vegetables in a too high recrementitious condition, proving bad producers, a reduction of which is found to be the best antidote against barrenness. Animals, in fact, as well as vegetables, are found to produce best when in a medium condition; the general recrementitious and excrementitious actions of their systems being then more upon an *equilibrium*, and by thus counterpoising each other, thereby preventing the mischiefs to which a preponderance of either give rise. The principal point therefore to be looked to in barrenness, is to ascertain whether it be owing to some *constant* excrementitious disease in the uterine parts, such as leucorrhæa, or to an *occasional* one, such as menorrhagia, produced by a *previous* too powerful recrementitious action in the female system. If the latter be the remote cause, then, by moderating of this by excrementitious treatment, we may succeed in preventing the excrementitious disease in the uterus to which it gives rise, and thus cure the barrenness consequent thereon. But should a constant excrementitious action in the uterus be the proximate cause, we must ascertain whether this be connected or unconnected with an existing too powerful recrementitious action in the system; because while excrementitious treatment benefitted the first, it would be pernicious in the latter, stimulant or recrementitious substances being here demanded.

That a too high recrementitious action in the system is the most common cause (though a *remote* one) of barrenness, seems evidenced by the females subsisting upon the *least* recrementitious food being the most prolific; hence the greater fecundity of the poor than the rich, and of the milk and potatoe-eating Irish poor, than of the bread and beef-eating English poor.

PRESERVATION OF HEALTH.

THE sleep excited by cradle-rocking in infancy, may be attributed to the mass-electro-magnetism covering the body's surface, being made to circulate thereon in backward and forward currents, and consequently checked from entering the body in sufficient amount to keep up the usual activity of the mental and vital parts, on a diminution of which sleep is dependent; while cradle-rocking must equally tend to preserve infant health, by equalising the electro-magnetism of the body. During rest the superior parts of the body should be higher than the inferior parts in the northern hemisphere, and lower than the latter in the southern hemisphere, in order that the superior more important parts may acquire a fuller development, from electricity, the principle of growth, being thereby directed in greater intensity toward them. In recrementitious diseases, again, of these superior parts, they ought to be lowered in the northern hemisphere, and elevated in the southern, in order to check the flow of electricity constituting the food of the disease toward them, reversing of course these positions when the lower extremities were so affected. In excrementitious disease the parts affected ought of course to be elevated in the north, and depressed in the south, in order to repel from them the magnetism causing this disease, and attract toward them the electricity requisite for its cure. Night air is more liable to excite disease than day air, on account of magnetism or cold, the common exciter of disease, being necessarily more prevalent during the night than the day. The general objects to be kept in view for the preservation of health, are the following: —1st. Daily ablutions and frictions of the skin, in order to retain it in health, seeing it to be the medium through which the electro-magnetism is conveyed, on which all the important bodily functions are dependent for the effective performance of their respective duties. 2ndly. Moderate daily rotations to equalise the electro-magnetism through the body, and thereby prevent its causing local disease, by too great accumulation about any particular part. 3rdly. Moderation in diet, because health being dependent upon an equilibrium of action between the recrementitious and excrementitious vessels, hence an equilibrium in diet must be better adapted for an attainment thereof, than an extreme in either way. 4thly. Daily intestinal evacuations, the matter of which being excrementitious, is as liable to produce disease as any magnetic epidemia to which the body may be exposed. 5thly. Guarding against the depressing effects of excessive exertions or perspirations, by dry frictions of the body and change of linen, when such can be effected, and a moderate dose of some stimulant liquid; or, in the event of being unable to apply the above, and a chilly fit taking place, to walk briskly about, or cover the body with extra clothing, in order to retain it in a proper temperature, and thereby prevent the excrementitious action of cold air, or other magnetic gases upon it. 6thly. When epidemic or contagious diseases are prevalent, to wear small bags of camphor or other anti-contagious substances around the neck to prevent contagious inhalation by the lungs, and to insulate the local parts liable to be attacked with a close wrapping of flannel. Many are deterred from the use of flannel by its disagreeable feel to the skin, but its effects being as beneficial when above the shirt as when under it, therefore this need not be a bar to its use, the main point being the *closeness* of its application. After wearing flannel next the body for twenty years, I threw it off, and by means of daily ablutions and dry frictions with a towel, have enjoyed better health since, than I ever did before; those serving to me, as far as regards warmth, all the purposes of the flannel previously worn, which I now only have recourse to as a covering above the linen when very cold weather sets in. The flannel, however, to afford proper warmth, must be either new, or else bleached as soon as assuming a yellow tinge, by the fumes of sulphur, which abstracting the oxygen of the colouring matter thereby restore its former snowy tint, and consequently its former power of retaining the bodily heat. One of the best natural remedies in those subject to indigestion and constipation, is bread baked with the bran in it; which latter, by preventing the cohesion of the glutinous particles, not only enables the digestive juices to have a freer access to the whole of the stomachic contents, but also all the articles of diet made use of, to be more readily discharged after nutrition has been extracted from them. It is to the diminishing of the cohesion of soils by agricultural implements that the farmer mainly trusts for the return of a good crop, through which the moisture and air necessary to effective vegetation, are more readily admitted to the digestive organs, or roots of the grain; and hence by analogy how useful must not these substances be in animal digestion, which diminish the cohesion of the food, seeing that animal and vegetable nutrition are regulated by the same principles, and consequently what applies to the one must in a comparative sense apply to the other; a perfect mastication of the food being as essential to animal health, as a perfect pulverisation of the soil is to that of vegetables. When pain is felt in any part and a rotatory machine is not at hand, whirling round upon the heel is a good substitute, as I have often found; but every person who can afford it ought to have a rotatory machine, like those used at fairs, for the preservation of family health, which, placed under cover, would admit of the principal benefits derived from horse exercise being attained, at any season, without risk of exposure to atmospheric changes.

In cases of acute disease, however, a chair whirling upon a pivot spindle would answer best, on account of the circle of revolution being smaller, and the revolutions capable of being performed with greater rapidity. Recrementitious articles of food and drink being found to excite the animal spirits and heat the body, and excrementitious to calm the spirits and cool the body, hence a due equilibrium between the two must be maintained in diet, in order to retain the system in health; the cravings of the appetite being, as I have before said, the best test as to the diverse amount of each demanded by the body for the attainment of this point. The effects of various kinds of solid food being similar to those of stimulating liquors, hence we may conclude that the action of both is similar; this inference being borne out by an over dose of solid food or an over dose of spirits producing similar apoplectic results. Captain Lyons, in his amusing account of the Esquimaux, attests the intoxicating properties of over doses of seal-blubber upon these people, while the same effect is produced upon the South Sea Islanders by the unfermented kava, and upon the natives of New Holland by sugar and water, as is well known to most of the settlers there. Many individuals labour under the delusion that they lead a very regular life as long as they abstain from stimulant liquors, without dreaming that the quantity of solid stimulant food they may be indulging in, serves an equal purpose with the other in its effects upon the system; an excess in the latter, however, being necessarily infinitely more pernicious to health than an excess in the former, in consequence of solid matter having only *one* outlet to escape from the body by, when taken in over dose, while fluid matter has *many*.

CONSTITUTIONAL RENEWAL.

The views relative to the action of electro-magnetism in the human body, which inductive reasoning and the conclusions drawn from the changes it produces have led me to adopt, induce me to believe, that old age is not the cause of gray hairs, but that gray hairs are the cause of old age, by the progressive magnetic blanching and drying up of the juicy texture of the hairs, enabling them to progressively attract a larger and larger amount of magnetism, until the electricity which built up the human fabric, and retained it afterwards in vigour, no longer able to contend against the excessive magnetic introduction yields, gradually thereto; through which, life is eventually extinguished. If the above view be correct, therefore, provided we can accomplish the restoration of the primitive colour and juicy texture of the hair, and there be no organic disease of any important vital part, we will be able to restore the decayed body to all the plumpness and vigour of middle life at least. Every medical man must have observed that blisters to the head have either altogether eradicated gray hairs, or at least made them less common on the parts to which they were applied, by reconverting of the hairs to their original tint. The same effect is also often witnessed from the application of lunar caustic; and indeed blisters and caustic washes are at the present period successfully employed in changing the colour of the hair in the human subject, from gray to dark, while the white hairs upon the sites of sores in horses have their tint equally readily reversed by the blisterings and gunpowder ointment dressings used by the farriers.

The theory of the above reconversion of colour in the hair, seems referable to the insulation thereof from the magnetism of the atmosphere, by the non-magnetic conducting substances made use of, but whose electric-conducting properties enable electricity to be freely conveyed into the system, and thereby through the latter's eventual preponderance to progressively obliterate the ravages which the previous magnetic preponderance had effected. When the hair, therefore, in advanced age, can be so changed in colour and texture, as to carry the same proportion of electricity that it did in youth, this electric preponderance will naturally produce the same regenerative effects upon the body that it had previously done upon the hair. I have frequently read in the accounts of the lives of those who have died at ages greatly beyond the usual span of human existence, that they had renewed their hair and teeth in advanced years; a *natural* renewal of the former necessarily producing all the constitutional benefits of the *artificial* one now proposed, and therefore augurs favourably of the results that may be anticipated from it. The means proposed being indeed of a very simple nature, an attempt might, at all events, be made to ascertain how far the theory by which their beneficial effects are deduced, be correct. I would commence by shaving the whole body, and pencilling it over daily with a weak lunar caustic solution, until a sufficiently dark tint was obtained; and on this showing a disposition to peel off, put the patient, morning and evening, in a tepid bath for a few minutes, drying well afterwards, and rubbing in upon the skin some unctuous substance of the colour of the hair, such as charcoal ointment when the latter was dark, and palm oil, when of a yellowish tint.

In addition to the above, I would have the head insulated with cotton wool, before the peeling off of the caustic, and with plasters of lint and charcoal ointment, or palm oil, afterwards; employing at the same time moderate daily rotations, dieting moderately on nutritious soups and port wine, and retaining the body in proper warmth by sufficient clothing, and the mind in proper health by every agreeable amusement that could be devised. A few weeks of trial would be sufficient to ascertain the efficacy of the above treatment, as to whether a further perseverance therein would be advisable, tinting, however, in the interim, such hairs as had not changed their colour, and shaving all close twice a week at least, during the progress of the experiment. The greater portion of general, as well as of local diseases, whether chronic or acute, being made to yield to suitable treatment, I see no reason therefore why the chronic disease of old age should not be equally amenable to medical means, particularly when we become more fully acquainted with the causes thereof.

HEALTH OF SEAMEN.

Sea air being purer than land air, must, therefore, be more salubrious, yet seamen become sooner old than landsmen. This seems not so much owing to the species of food upon which they principally subsist, or the changes of climate and hardships to which they are exposed, as to the badly ventilated state of their sleeping berths, through which their rest is broken, and a morning lassitude and feverishness thereby brought on. A plan has been recently introduced into some of the line of battle ships, of berthing the seamen upon the orlop deck, which, though answering tolerably well in cool climates, must be most disastrous to health in the hot, on account of the smallness of the scuttles by which the orlop is ventilated not admitting a sufficiency of air, even when they are open, which latter can be seldom admitted of, except when the vessel is in port. As, however, a ship would gain greatly in warlike efficiency by such an arrangement, a due ventilation might, I conceive, be ensured in all weathers, by increasing the height of the orlop, so as to enable it to contain a larger volume of air, and having air-holes in the lining of the ship's sides, communicating with the various decks above, for furthering the escape of the foul air from the orlop. This might be readily effected, by leaving about an inch of open space between the edges of the plank lining of the ship's sides in the various decks, so that from the sides not being solidly filled, the foul and heated air would escape upwards through the crevices therein, and finally pass off by the openings of the linings in the decks above. This is, in fact, but a following up of the plan now pursued on board new ships in ordinary to prevent dry rot in their timbers, which would equally answer that purpose at sea, besides securing the health of the men from any noxious effluvia that might be engendered by defective ventilation.

It is adjoining the ships' sides that the foul air is most intense in the orlop, from having no exit there except when the scuttles are open; but when permanent air canals are established, the above foul air, by rushing upwards through these, will necessarily cause a counter current of fresh air to rush downwards through the hatchways, by which a more perfect ventilation of the sleeping deck will be ensured. The scuttles should indeed be opened as often as practicable at sea, to attain this point—even a few minutes opening of them being sufficient to renew the whole air of the deck, while all the crevices between the timbers of the ships' sides *below* the orlop should be solidly filled with Roman cement, to prevent the lodgement of filth, and consequently the engendering of miasma. The beneficial influence of dry decks upon the health of seamen is now so well appreciated, that washing of the sleeping deck, at the present period, is as much as possible dispensed with; but a great part of the evil of washing, still applicable to the other decks, might be avoided, by constructing them of teak, or some equally hard resinous or oily wood, which not imbibing the water like the spongy white pine in common use, would thereby enable the decks to become dry in nearly as many minutes as they now require hours.

The privilege of spreading the beds upon the deck in hot climates, would also have a beneficial influence upon health; because the coldest and densest air being always the lowest, hence the lower the sleeping berth, the cooler it would naturally be. It may be said that the deleterious carbonic acid formed by the respiration, being heavier than the atmospheric air, would consequently always occupy the lowest situations, but this is not found to be the case where ventilation is effective; while notwithstanding it is the heaviest of the gases in the northern hemisphere, it may probably be found the lightest in the southern, when the relative weights of bodies in the two hemispheres come to be tested.

Although the provisioning of king's ships be infinitely superior to those of merchant ships, on account of the greater variety of diet, and greater number of articles of comfort supplied, yet an important improvement might still be made, by having such articles of rations as the countries produce, where ships of war are stationed, furnished fresh on the spot, instead of being furnished in a stale state from England. Every one who has been upon the Chilian station, must have had the propriety of this strongly impressed upon him—beef, pork, flour, and biscuit, the produce of the country, being supplied at a cheaper rate there than in England; and the feeling of alarm among the ships' crews at the report of a store ship's arrival, plainly evincing which of the two was most congenial to their palates. The human appetite, indeed, like the human mind, must have food of an agreeable nature supplied, in order to retain the body in health—the very dislikes of the mind or the palate showing, that a forcing of such upon them would be prejudicial to the body. Hence the great utility of having, as in a ship of war, a variety in the articles of diet, so as always to be capable of suiting the demands of the palate, whether that demand be for articles exclusively recrementitious or excrementitious, or merely for some variety in each. Hence the delight with which sailors return to their salt rations after having been for some time on fresh beef and vegetables, and the equal delight with which they return to the latter, after having been for some time on the former. That fresh beef is to a certain extent less recrementitious than salt beef, is evidenced by the fresher and fatter looks of the seamen after dieting for a few weeks thereon, as well as the greater number of boils and inflammatory affections during this period; salt, in *moderation*, being found one of the best fattening articles that can be prescribed for animals or vegetables, while in excess it is equally destructive to the vitality of both from the secondary excrementitious action, to which the excessive primary recrementitious one gave rise. In fact, when food becomes too recrementitious, either from the stimulant substances, such as salt, which it contains, or from its easier digestibility, in consequence of being in a partial state of decay, the progressively diminished cravings of the appetite for it thereby preserve the body for a longer period in health, by permitting it to be received only in progressively diminished quantities into the stomach; so that the staler bread and meat are, the *more* satiating they become, and the fresher, the *less* so; stale bread being invariably prescribed in cases of indigestion, in consequence of its readier decomposition by the juices of the stomach.

It is only, however, when in a slight state of decay, that articles of diet can be wholesome, because, when farther advanced, their decomposition may be so readily effected, that the intense galvanic action thereby excited in the stomach, may prove poisonous by destroying the vital texture of the latter. The state of their decay, with reference to their wholesomeness as food, will of course depend entirely on their comparative facility of decomposition, or digestion, when in a *fresh* state;

the more difficult of course their digestion in the latter state, the more advanced may their decay be permitted to proceed before being submitted to the ordeal of the palate. The salutary effects of a natural restraint upon the appetite, just before exemplified, forcibly point out the firm foundation in nature, which the Abernethian system of regimen lays claim to, showing, as the previous does, that even the *natural* monitions of the appetite, to diminish certain articles of food, are generally insufficient for the prevention of disease, and that *artificial* restraint is required in the majority of cases for the accomplishment thereof.

CONCLUDING REMARKS.

The general views taken in the preceding essays, tend to show that simplicity is the grand feature distinguishing all the works and laws of the Creator; the two simple elements, electricity and magnetism, not only producing all the revolutions and changes in the earth and the heavenly bodies, but also the conception, growth, and decay of every living animal or vegetable substance throughout our globe. They further tend to show that the atomic theory of proportion, as relates to the constitution of dead matter, applies equally to that of the living matter of animal and vegetable existence. They tend to simplify scientific and medical research, by all changes in matter, whether animate or inanimate, being shown to be dependent on one simple cause, through a knowledge of which, the changes in the earth and heavens will be more readily unravelled, human health more efficiently preserved, human life more efficiently prolonged, and the treatment of all diseases equally simplified by making this treatment referable to the leading action, electric or magnetic, characterising the complaint.

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LONDON:
PRINTED BY BRADBURY AND EVANS, WHITEFRIARS.
(Late T. Davison.)

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